PENTAGON GAMES

Wargames and the American Military

JOHN PRADOS

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Includes three playable wargames

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For Gamers
Everywhere

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PREFACE

This book is about gaming by the military, especially the American military establishment. It is about the kinds of games being designed, the ways in which they are used, and the problems involved in drawing knowledge from them. This is not a book about games in general but about the ones that generals play—wargames.

Wargames go back several centuries, both as tabletop exercises and as maneuvers in the field with actual troops. This longevity is perhaps due to the fact that playing such games is the only "practice" possible aside from fighting real wars. Today military officers are exposed to conflict simulations at several stages in their careers. The games enable officers to visualize the potential for various strategies, to determine desirable tactics for attack and defense.

What the military man sees when he participates in a wargame, however, is but the tip of the iceberg. Players are only using the results of design efforts by the experts who invent the games. It is the responsibility of the experts to inform users about the value and limitations of the method. This is especially true today, when wargames are riding a new wave of popularity. Whether simulations can achieve perfect "realism" and successfully predict the future or whether they are dangerous contrivances remains to be seen. I find them an intriguing, unique look inside the military mind—a study of its tough reflexes and its fears. And, as games, the element of play is exciting.

I am a wargame designer. For over a dozen years I have created conflict simulation models, not for the military but for gamers—hobbyists who bring the intensity of chess masters to these tabletop replicas of warfare. In the course of this work I have followed the progress of military simulation efforts. It is impossible to read the defense literature today without noticing the resurgence of interest in wargames. I have become concerned that wargames are being oversold and that unsubstantiated claims are being made for them. That concern is the reason for this book.

My account begins with a survey of the history of wargames and then focuses on their use by the American military in the years since World War II. I shall then examine our knowledge about war and how it is reflected in games, how wargames are created, and how international crises are simulated through politicomilitary games. In conclusion I cover the danger of the mystique of wargames, a danger we must heed, as wargames, like the powerful weapons they model, now include the entire globe in clear target range.

This work also contains three games of my own design. The game *Pentagon* creates in a tongue-in-cheek fashion a form of "bureaucratic politics." This is intended to illustrate some of the factors other than "knowledge" that have a direct impact upon defense spending. *The R&D Game* shows how a military project moves from the drawing board into the hands of troops in the field, though I

have simplified this process for game purposes. Nevertheless, the array of factors other than simulation studies and analyses that figure in project development is readily apparent. The final game, *Last Days of Saigon*, takes the form of a "manual" wargame, simpler than the military standard but of the same type. Vietnam was the most studied, analyzed and simulated war in the history of the American military. *Last Days of Saigon* is a reminder that the best possible study and simulation provide no guarantee against defeat on the battlefield.

Publication of this book would have been impossible but for the assistance of many people to all of whom I am indebted. This especially includes the persons who were interviewed but must remain anonymous. I must apologize in advance to some colleagues in the defense gaming establishment because for reasons of space and narrative continuity a number of notable wargames, "think tanks," and service game activities have been excluded.

Kevin Zucker, a noted commercial wargame designer in his own right, prepared the graphic artwork for the games *Pentagon* and *Last Days of Saigon*. Necessary typesetting for those games was ably executed by Barry Meisel. Tamara O'Bradovich, a tireless worker for Harper & Row, created the page graphics for *The R&D Game*.

A special requirement in creating games is testing them before they are produced. For testing the game *Pentagon* I am indebted to Paul Dobbins, Daniel A. Gouré, and Joel S. Wit. The credit for testing *The R&D Game* goes to Messrs. Dobbins and Gouré and also to Jamie Adams, Abbot Kommers, and William Kommers. Play-test credit for *Last Days of Saigon* leaves me indebted to James Dingeman, Abbot Kommers, William Kommers, and Albert A. Nofi. I stand in awe of their playing skills.

This narrative has been greatly improved by the people who commented on earlier drafts, whole or in part. These include Jamie Adams, Daniel del Solar, Jill Gay, David C. Isby, J. A. Nelson, John Sloan, Joel S. Wit, and Kevin Zucker. Also of crucial importance have been my editors at Harper & Row, Harriet Rubin and John Michel. Any errors of omission or commission are my own.

—John Prados
Washington, D.C.

If you take a flat map
And move wooden blocks upon it strategically
The thing looks well, the blocks behave as they should
The science of war is moving live men like blocks
And getting the blocks into place at a fixed moment
But it takes time to mold your men into blocks
And flat maps turn into country where creeks and gullies
Hamper your wooden squares. They stick in the brush
They are tired and rest, they straggle after ripe blueberries
And you cannot lift them up in your hand and move them.
—A string of blocks curling smoothly around the left
Of another string of blocks and crunching it up—
It is all so clear in the maps, so clear in the mind
But the orders are slow, the men in the blocks are slow
To move, when they start they take too long on the way—
The General loses his stars and the block-men die
In strategic defiance of martial law
Because still used to being men, not block parts

—Stephen Vincent Benet
John Brown's Body

PENTAGON GAMES

CHAPTER 1

GAMES GENERALS PLAY

In September 1941 the Japanese Naval War College was the setting for fleet wargames that determined the tactics the Japanese would use to attack the United States and its allies in Asia later that year. These tabletop wargames were not new to the Japanese, whose naval general staff commonly held a series of games each year in the autumn. But the games of 1941 involved more players than usual and required special facilities for separate gaming of certain top-secret military plans.

One aim of the 1941 games was to establish a timetable for operations against the Philippines and Southeast Asia. Three teams participated in this wargame, one each to represent the United States, the British, and the Japanese themselves. In this respect the games were quite successful—when Japan went to war in December 1941 the "southern operations," as the Imperial Navy called them, proceeded like clockwork, following almost exactly the schedule established in the War College simulations.

The most interesting games, however, took place in a closed-off room in the school's east wing. Here the Imperial Navy tested its plan to attack Pearl Harbor.

The concept of an attack on the main American naval base in the mid-Pacific was fathered by Admiral Isoroku Yamamoto, then the senior Japanese fleet commander. Many officers of the Imperial Navy who knew of Yamamoto's plan had doubts about it, and the admiral thought that wargaming the operation could help to defuse the opposition. Having contemplated making his attack with a group of aircraft carriers, Yamamoto and his top staff officers developed a scenario for such a naval-based wargame and convinced the general staff to include it in the program.

The "Japanese" team in the game consisted of the actual staff of Imperial Navy carrier force commander, while the "American" team was headed by the senior naval intelligence expert on the United States. Teams sat in different corners of the room, and no direct contact was allowed between opponents. Both teams were supplied all their information by umpires who made all judgments on the success of the orders sent by the teams to their hypothetical forces. Wargame rules determined what the forces could do in the simulation and how the umpires were to resolve combat situations as they occurred in the game.

In fact, the Pearl Harbor game was played twice. During the first game, the Japanese team disagreed over the route their fleet should take in steaming toward the American base, while Captain Kanji Ogawa's American team adopted the tactic of using many aircraft for extensive searches of the waters surrounding Pearl Harbor. The American players received several early reports indicating the presence of Japanese ships, and Ogawa's hypothetical search planes spotted the Japanese carrier fleet the night before they reached attack positions for Pearl Harbor. In the wargame "morning," the base and

the fleet traded air strikes, but Captain Ogawa had Pearl Harbor's fighter planes in the air waiting to intercept the "enemy" planes, and the base itself was on alert. The result was that the Japanese team inflicted only minor losses on Pearl Harbor but lost half its planes. The American bombers that followed the planes back to their aircraft carriers then sank two carriers, half the hypothetical Japanese force. The outcome could only be regarded as a stunning defeat for the Japanese team.

In the second game, the Japanese team followed a different course across the Pacific. They sailed from northern Japan and approached from due north, a direction the Americans might least expect. The hypothetical Japanese fleet paid much more attention to the danger of early detection by American searches and timed its approach to minimize exposure. These new measures proved wildly successful, and there was complete surprise at Pearl Harbor. When the umpires resolved the attack, they judged four of the eight battleships and two of the three American aircraft carriers sunk at their moorings. One additional battleship and the last hypothetical carrier were listed as badly damaged.

With these results in hand, Admiral Yamamoto was able to override the opposition to his plan. On December 7, 1941, real Japanese airplanes struck at Pearl Harbor in a surprise attack out of a Sunday dawn. As in the wargame, the Imperial Navy operation had been carried out in total secrecy, it achieved complete surprise, handing the United States one of its worst military defeats ever: almost 5000 persons killed or injured, seven battleships sunk or damaged, 250 aircraft destroyed.

In its attack the Imperial Navy was both lucky and skillful. The Americans were lucky only in that their own aircraft carriers happened to be at sea and thus escaped destruction at Pearl Harbor.

Japanese staff planners obviously learned much from exercises such as the Pearl Harbor wargame. But what is truly surprising about this experience is that the Americans should have known better *from the results of their own wargames*. Prewar naval maneuvers on several occasions had illustrated aspects of the plan adopted by the Japanese. Some of these wargames had had precisely the same result as the Imperial Navy's tabletop simulation of the Pearl Harbor plan.

The U. S. Navy had used tabletop wargames for mid-career training of officers at the Naval War College for many years before Pearl Harbor. The school used a simulation known as the *Strategic Naval War Game* to teach everything from search patterns to making quick decisions at sea. In fact, fully 304 days of the standard 326-day course were occupied with aspects of the game. These ranged from preset tactical and operational exercises to a game-board replay of the historic battle of Jutland to special situations developed by the War College.

Some of the interwar special situations wargamed at the college shed light on the particular concerns of the navy. For example, in 1919, long before aircraft established any predominance in naval warfare, students were given a game problem in fleet air defense. Defense of the Philippines or an advance toward those islands was gamed almost annually: these games clearly showed the impracticality of the existing war plan, which called for a rapid deployment to the western Pacific. The defense of, or an attack on, sea lines of communication was featured in at least 28 wargames during the interwar period.

Through gaming we were well prepared for war with Japan. Fleet Admiral Chester W. Nimitz, our wartime Pacific commander, told a Naval War College audience in 1960 that "the war with Japan had been reenacted in the game rooms here by so many people and in so many different ways that nothing that happened during the war was a surprise—absolutely nothing except the kamikaze tactics toward the end of the war."

These are some of the games generals play. But generals do not just play games, they use them in war. And though the existence of an industry that creates wargames and a league of hobbyists that play them is a development of the latter half of the twentieth century, the history of wargames is a story of the innovation and refinement of a tool for the military.

Wargames have become important to the military because the games mimic the process of warfare, allowing the military to experiment with different kinds and numbers of men, weapons, and equipment or strategies and tactics. The wargame performs this function by means of constructing a model of the different processes that interact in war. Ideally the wargame *simulates war*. The essential definition to keep in mind is that the wargame, whether played by individuals over a board or map or by troops in the field during military maneuvers, uses methods other than fighting to generate plausible outcomes from combat. And the history of wargames shows a steady increase in the sophistication of these simulation methods. Indeed, wargames have gained acceptance from military

men precisely because of the game's simulation realism.

Pearl Harbor was an object case of the military utility of wargames. By 1941, however, simulation was hardly a new or novel method of training and strategy planning. Here we shall review several primitive wargames that marked the birth of military simulation.

Though not systematically used for military training, such classic, truly ancient games as *Chess*, *Go*, and *Shogi* were strategic in nature and are essentially about war. Several features mark *Chess*, for example, as a precursor to the modern wargame. The object is to capture the opposing force, the pieces have distinct values and patterns of movement, and the board is divided into square areas intended to regulate the movement.

The earliest board wargames were essentially derivatives of *Chess* and could be simply described as "war chess." One of the first known games of this type, designed in 1644, was called *The King's Game* and featured 30 pieces per side, of 14 types, each with a fixed manner of movement.

The games first known to have been used for military training, however, were not at all simulations of warfare. French soldiers during the reign of Louis XV (1717–1744) played a card game known as *Le Jeu de la guerre* (The Game of War) and another called *Le Jeu de la fortification* (The Game of Fortification). These were rummy-type card games that simply familiarized the troops with military concepts and terminology.

Toward the end of the eighteenth century two new wargames appeared in the style of "war chess" that greatly improved the techniques for simulating war. The first was created by Helwig, Master of Pages to the Duke of Brunswick, in 1780. The game board consisted of 1666 small squares in six colors for different kinds of terrain. It used 118 pieces for military units—so sophisticated as to include infantry, engineers, two kinds of cavalry, and three types of artillery. Each type of piece had a different capability and movement rate. An umpire was introduced for the first time to arbitrate disputes. The second game, *Neues Kriegspiel* (New War Game), was specifically intended for military schools by its designer, the Silesian Georg Venturinus. Although this game essentially dispensed with the chess board, it still used squares—3600 of them superimposed on a map of a portion of the Franco-Belgian border. Up to 2600 pieces could be accommodated, including infantry and cavalry brigades and artillery batteries. Most significant about the Venturinus game was that players' movements began to approximate the way real troops would march, by giving pieces different rates of movement depending on the terrain in the squares they entered.

The first real advances in developing the modern wargame began in 1811, when the Prussian war counselor in Breslau, Herr von Reisswitz, designed a game that gained the attention of the royal court. Reisswitz made two important contributions toward converting wargames from a curiosity into what is today regarded as simulation. First, he adopted a standard scale in representing the proportion, weight, and capability of all elements in a real situation, endowing them with the same relative attributes in the game. Reisswitz adopted a scale of 1 to 2373 and, calculating the space required by units of infantry, cavalry, and artillery, made wooden pieces to size, marked by unit type. Reisswitz's second contribution was in using a sand table for terrain instead of a board, which allowed the game "map" to be changed and also avoided the artificiality of a square grid. It was a long step in the direction of realism and it demonstrated that specific *design features* of a game could be used to approximate reality.

Two young Hohenzollern princes were told of this new game and asked to see it. Reisswitz went to Berlin and was given a room in the palace to display the wargame—this time with a cast-plaster terrain map. The princes were enthusiastic and related news of this powerful new tool to the king. By 1812 Reisswitz had been granted an audience with King Frederick William. He presented the Prussian king with a special set of the wargame including molded porcelain pieces, and from that day the king himself became an avid wargamer.

But royal interest was not the same as wide acceptance. It fell to the designer's son to accomplish the latter. The younger Reisswitz made many improvements in the design of the wargame called *Kriegspiel*. He changed the standard scale to 1 to 8000, allowing the game to portray much larger situations. He began to use metal pieces colored red or blue (a convention preserved in many wargames since). Neither side was permitted to see the actual game map where the pieces were displayed in their positions. Instead, the role of umpires was expanded to include executing all maneuvers on the game board, based on "orders" given by the players. Any information players received about the game situation henceforth came through the umpire, who also began the game by giving each side a "general hypothesis" and a "special theme"—

the hypothetical situation we call a scenario today. When battles occurred, the umpires calculated outcomes using dice to inject an element of chance into the game.

After watching a demonstration of this improved *Kriegspiel*, the Prussian chief of staff exclaimed, "It is not a game at all. It's a training for war!"

Wargames followed in Germany and in other countries one upon another and continued to gain acceptance. By the advent of modern warfare at the end of the nineteenth century, wargames were used to some real effect by military planners. At the time of World War I, the techniques of simulation were in use in most European countries, in the United States, and in Japan. And the use of games in World War II by Allied and Axis powers had become commonplace.

In December 1940, during their preparations for the invasion of Russia, German senior army commanders, including the general staff, carried out a two-day *Kriegspiel* of a war against the Soviet Union. The game showed that the German army would be barely adequate for the ambitious aims of the offensive—that all reserves would have to be committed before the final phase of the campaign and that the strength of the southern wing of armies—those assaulting from Rumania and through the Lvov gap in Poland—would be crucial. In the actual campaign, German intelligence proved to be wrong, and the Soviet armies were even stronger than expected. As in the wargame, Army Group South was the first to be forced to halt its advance and even had to retreat before the end of the 1941 invasion campaign.

Ironically, German reaction to the Allied invasion in Normandy four years later was delayed in part because a number of the commanders on this front were attending a *Kriegspiel* of an invasion on the day the invasion occurred! Perhaps the most remarkable use of wargaming by the Germans came after the Allied push across France and the Low Countries. Concerned about the possibility of an Allied advance through the Heurtgen Forest to the Roer River dams, which would have threatened the ink between two German armies, leaders of the Fifth Panzer Army decided to wargame this situation. The simulation had just begun when American divisions initiated the feared attack. Field Marshal Walter Model ordered his subordinates at Fifth Panzer to continue the wargame but to substitute reports from the front for the information usually given to players by the umpire. In this way the Germans used the wargame to plan for effective commitment of their reinforcements and halted the offensive. Six weeks later the Germans were able to begin the counteroffensive known to history as the Battle of the Bulge.

Wargames came to America during the latter half of the nineteenth century. There were translations and adaptations of European designs, but the several American-designed games of that period did not attain wide popularity. The United States Army first adopted wargames for training, at the Army Staff College in Fort Leavenworth, only in 1907.

The Navy was quicker to adopt wargaming methods. (Naval wargames had been proposed in Europe as early as 1790, and a variety of simulations was created by officers in the British, Italian, and Russian navies soon after the Franco-Prussian War.) Navy wargaming in America began at the Naval War College in 1894 and has never ceased. For the first two decades of the twentieth century, games were used primarily as analytic tools in planning and evaluating new technologies. The design of the *Brooklyn* class of light cruisers, for example, built during the 1920s and 1930s under the Washington Naval Treaty, was based on validation by wargame results.

Beginning in 1921 wargaming was used more for educating officers than for testing ideas, and the *Strategic Naval War Game* became a vital part of the lives of all students at the college, leading to the pre–Pearl Harbor simulations already mentioned. By World War II the military simulation had become firmly established worldwide. Simulation techniques had acquired a certain sophistication, especially in the standardization of methods for representing units, terrain, and combat. The addition of umpires and the steady expansion of their role in wargames also gave military men greater control in how the games were conducted. These factors helped assure the increasing acceptance of wargames by the military.

Wargames had a concrete effect on military operations. Although the impact of simulation was decidedly negative on occasion, it is clear that by World War II military forces across the globe were conducting wargames and taking their results into account in operational planning. By 1945 simulating war through games was common in nearly every military school and defense department. The postwar period, with the opening of the Cold War, witnessed a virtual explosion in wargaming.

CHAPTER 2

THE POSTWAR EXPLOSION IN GAMES

No major campaigns had been fought in Europe since 1955. During a three-year unofficial truce Aggressor had been able to build up his forces in the Homeland in addition to augmenting his embattled forces overseas. Concurrently with stepping up the tempo of his offensives in the American Theater, Aggressor decided to resume his attacks in Europe in order to drive the United States and its Allies from the Continent.

In January 1958 the U.S. Forces in Western Europe opposed by a superior Aggressor force carried out a general withdrawal. This retrograde movement by U.S. Forces caused Aggressor to overextend his forces, leaving himself open to a counteroffensive by U.S. Forces. On February 15, 1958, the U.S. Forces launched a counterattack against the Aggressor forces driving them back to their original line of departure. U.S. Forces as well as Aggressor employed nuclear weapons. Aggressor suffered heavy casualties, thus eliminating offensive action.

—U.S. Army Aggressor Order of Battle Handbook, 1959

A certain amount of fictional history was invented by the Army to lend plausibility to its maneuvers and map wargames. Battle reports, similar to the NATO defensive above, were created for many campaigns, as were capsule histories of Aggressor units and even biographies of fictional Aggressor commanders. For field exercises, troops playing Aggressor were given uniforms dyed a special dark green plus helmet liners with wooden crowns resembling helmets worn by the Roman Legions centuries ago.

According to the 1959 edition of the Army's *Aggressor Order of Battle Handbook*, the Aggressor nation "arose out of the chaotic conditions which characterized many areas of the world at the end of World War II." It was a nation formed within a large landmass, having a population of 200 million in 1955, under the authoritarian leadership of the "Circle-Trigon" party, whose membership represented less than 5 percent of the population. Hostilities between the U.S. and Aggressor began within a year of the end of World War II when an Aggressor force seized Cuba, Puerto Rico, the Antilles, and the Panama Canal. The Aggressor expedition then sailed through the canal to invade California. Aggressor was defeated by Marines and Army troops in Operation Oilskin, the first use of the Aggressor concept in a field maneuver.

Over the following years there were repeated campaigns in Florida, the Carolinas, Tennessee, Panama, Puerto Rico, and central Europe. In 1955 Army and Marine forces combined to fight Aggressor in "grand joint maneuvers" in the Carolinas. But in 1958 the "Circle-Trigon" leaders were considered to control Florida, the coasts of Texas and South Carolina, the northeastern United States, enclaves in California and Alaska, the Caribbean, and interestingly enough, portions of South Viet-

nam plus all of North Vietnam. By the early 1960s Aggressor forces had fought their way across the Rocky Mountains and as far east as Denver.

This continuous development of an elaborate history to accompany the simulated campaigns of the Russian caricature Aggressor is an indication of the strong belief in the usefulness of wargaming during the Cold War period. During this period, the military's interest in wargames—in the form of maneuvers, map-based conflict simulations, and even political crisis simulations—reached unprecedented highs.

Perhaps an even better measure of the serious interest in conflict simulations is the less value-laden, more strategically oriented notion of Opposing Forces (OPFOR), a more modern "enemy," which eventually supplanted Aggressor. With the advent of computer and laser technology, OPFOR was able to combine high-tech board-gaming techniques with the practical realism of ground maneuvers.

One of the most radical advances made by OPFOR was in the role of umpire. In both the map-based games and the field exercises against Aggressor, the simulation of warfare was controlled by umpires who relied on personal experience to make reasonable judgments as to the effects of actions made by the players. In an effort to use computer technology to take gaming one step further from human error, the Army devised Opposing Forces with the computer playing umpire. The effect of computer technology on the traditional style of maneuvers matches its impact on abstract wargames. Where the umpire formerly held full sway, the computer has now become the final arbiter because of its ability to judge objectively the effects of fire and the legality of moves. Umpires could be influenced by persuasive argument, computers cannot. And computers, combined with lasers, laser detectors, and radios, have created a style of high-tech military maneuvers that has already reached an apogee of sorts in the southwestern United States, at Army and Air Force bases within a few hundred miles of each other.

The Army's high-tech wargames are held at Fort Irwin, in the Mojave Desert, halfway between Las Vegas and Los Angeles, a base that had been closed, as a cost-cutting measure, since the late 1960s. At a cost of $300 million (and an additional $110 million yearly to operate), Fort Irwin reopened in 1980 as a national training center for the Army. The core of the center is an automated wargame in which real soldiers are the pieces. A vital element of the Fort Irwin wargame formula is the wide variety of sensor technology developed originally for the "electronic battlefield" of the Vietnam era. Installed throughout the training center, these sensors make it possible to compile an accurate, complete, and up-to-the-minute record of the progress of each wargame. The record-keeping capabilities of the center are further supplemented by four camera crews who actually film the crucial moments of simulated combat. Army officers can play back each maneuver and critique it in detail at the end of each exercise. Fort Irwin becomes, in effect, a battlefield laboratory. In casual recognition of this game aspect of the maneuvers, Army soldiers have dubbed the maneuver control center Pinball.

The Army has also inaugurated a novel system of training whole units as a result of the melding of several gaming types. One of these was the evolution of the Aggressor concept. The old Aggressors might have had different uniforms and Soviet-style unit designations, but they used American tactics and operated U.S. equipment. In many ways they provided little realism in simulating an actual U.S.-Soviet conflict. There was therefore growing interest in a maneuver force that simulated Soviet equipment, doctrine, and tactics. This became possible after the 1973 Arab-Israeli war, when the Israelis captured a large quantity of Soviet equipment, a windfall for the U.S. Army. The Army used some of this equipment to experiment with a Soviet-style unit at Fort Hood, Texas. This unit became a part of OPFOR and eventually replaced Aggressor in the Army lexicon. The program now combines the Soviet-style unit with the battlefield laboratory.

In the meantime, developments in computers and laser technology made possible a new way to compile and score casualties in simulated combat. Laser "painters" were built into regular-issue Army weapons, each man or piece of equipment wore a transceiver to score laser "hits" and transmit the data to "Pinball." This Multiple Integrated Laser Engagement System (MILES) is the heart of wargame operation. In the idiom of the computer age, Fort Irwin has been renamed Fort Atari by its denizens.

In the Fort Irwin wargames, the visiting force is blue. The National Training Center can accommodate 2000 "blue" soldiers. Awaiting them is a brigade set of equipment, 175 vehicles, and other standard Army materiel fitted with the laser painters and radio transceivers. (The cost for the laser

system alone, installed in standard combat equipment, ranges from $1325 for an M-16 rifle to over $11,000 for an M-60 tank.) The visiting units, drawn either from the continental U.S. or from forces deployed overseas, pick up this pre-positioned equipment and take the field against OPFOR. There is a "game within the game" aspect to the maneuvers as well, since even while picking up their pre-positioned equipment, the visiting blue force is executing a task just as they would be required to do if called upon to reinforce NATO Europe in the event of war.

The Navy experienced a similar postwar boom in military gaming and had in fact begun work on electronic simulation very shortly after World War II. Although design of the first computerized naval wargame began in 1948, it was not until the mid-1950s that sufficiently powerful computers became available to "drive" the game. This simulation was called NEWS (Naval Electronic Warfare Simulator) and cost over $10 million. NEWS capitalized on the technological innovations embodied in the computer and in television screening, which permitted the creation of an animated monitor map that provided a control group of umpires with the actual locations of all forces of all players. Side screens displayed the status of each unit in designated force of a ship or ships or aircraft), and lights flashed when targets were "acquired" (discovered) or when a combat sequence began. Up to 48 units could be handled and displayed simultaneously. The NEWS wargame could play out a situation minute for minute or at a quarter of "real time."

Not surprisingly, this game was visually striking and operationally quite impressive. A delegation from the American Management Association, invited to Newport in 1957 to see Navy wargaming in action, was so taken with its possibilities that the AMA initiated designs of business, production, and management simulations, a type used by 64 American universities by the mid-1960s.

However, the jet age arrived before NEWS was ready for use, and atomic weapons altered previous notions of the vulnerability of naval vessels. The deployment of guided missiles aboard warships of the Soviet navy introduced a further revolutionary element into traditional concepts of naval battle. The NEWS design had been created at a time when surface gunfire retained a major role in battles at sea, and when aircraft were much less capable than jet fighters. In addition, the rapid improvements in computer technology that followed the introduction of NEWS meant that the system quickly became obsolescent.

The Navy considered a replacement for NEWS in 1966. It decided to create an entirely new computer game system, the *Warfare Analysis and Research System*, or WARS. Of course, the new wargame was far more sophisticated than its predecessor. Able to display units located anywhere from 10,000 feet beneath the surface of the sea to 200,000 feet above it and to simulate warfare up to 40 times faster than "real time," it allowed the simulation of days and weeks of events in minutes of game time.

But WARS was so advanced that it became mired in its own technical sophistication. Computers quickly became even speedier than the one that had been specially built for the wargame, and the Navy tried to keep pace with the state of the art by modifying WARS with additional software and hardware. Eventually the game's computer had become such a contraption that only one electrical engineer remained familiar enough with the system to be able to repair it! Not only was the Navy forced to hire outside consultants to supplement its own staff, but by the originally scheduled completion date only 40 percent of the simulation was ready, and naturally there had been cost overruns as well.

Since 1975 the simulation has been rebuilt and retitled the *Naval Warfare Gaming System* (NWGS). It is still located at Pringle Hall, the specialized gaming building at the War College, and continues to use portions of the equipment developed for the original NEWS wargame, particularly its video displays. Today the NWGS simulation provides for about 100 wargames a year—some educationally oriented, others for research or operational testing—plus a regular series of "fleet readiness exercises."

The Navy also holds maneuvers with its task forces at sea, using shipboard computer simulators and tabletop naval games, but the capstone of the naval wargame effort is the three-week-long *Global War Game*. The simulation is conducted at the Naval War College during the summer when officer classes are not in session. Up to 350 players are involved, divided into teams representing national leaders, theater commanders, fleet commanders, land force leaders, and allied nations. Europe, the Pacific, and other regions are each separately simulated, either with a red team for the adversary or by the green team of umpires. The existing NWGS is used to wargame combat at sea, while land war-

fare is handled using a model developed at the Army War College.

These games often reflect the eruption of current world crises. For example, in 1983 the *Global War Game* featured a scenario in which conflict resulted from unrest in central Europe. Supplying the forces turned out to be a special concern in that run of the game. The 1984 scenario focused on the conduct of a "long" war and again provided special treatment of the logistics requirements for combat of this intensity. In this simulation the "Soviet" offensive was halted successfully in Europe, but situations elsewhere in the wargame world were more difficult to restore. Most disturbing was the fact that there seemed to be no way to end the war once it had begun.

The Air Force has also taken advantage of the latest development in computer technology. Its national training center is at Nellis Air Force Base in Nevada, where it operates an instrumented air maneuver area surrounding the Nevada nuclear test site. Under the rubric of the *Red Flag* program, laser pods, radar plots, and gunsight cameras are used to assemble complete records of mock air battles. A blue force of up to 80 planes and 1400 airmen moves out to Nellis in a replica of the contingency plan to reinforce NATO with air power, practiced each year in exercise *Cold Fire*. Visiting blue-team planes fly against squadrons trained to simulate Soviet-style tactics, which, harking back to an earlier day in the Army, the Air Force has designated "Aggressor."

One especially large *Red Flag* exercise was held in 1980 when 140 aircraft were sent to Nellis and chalked up over 3000 sorties, about 50 percent more than the average. That 1980 exercise was also notable as an early operational test of the E-3A Airborne Warning and Control System (AWACS). In this wargame, AWACS aircraft coordinated over 100 air support missions and even more interceptions, in which some 800 fighters participated.

These electronic simulations of air battles have been very well received by the military since *Red Flag* opened in 1975. Seven such exercises are now held each year, and the Tactical Air Command has supplemented maneuvers at other bases with programs dubbed *Blue Flag*, *Green Flag*, *Black Flag*, *Silver Flag*, *Gold Flag*, and *Copper Flag*. There is even a *Maple Flag* exercise in which Canadian pilots and planes operate together with Americans. The United States has also opened additional air maneuver areas in the Philippines and the Mediterranean.

One gauge of the effectiveness of this kind of training is evident from the impact of the U.S. Navy program *Top Gun*. The Navy initiated *Top Gun* during the 1960s to study the dissatisfactory combat exchange ratios its pilots were experiencing during the Vietnam War. Although it focused on teaching advanced air tactics rather than explicitly Soviet-style tactics, *Top Gun* resulted in significant gains in the combat exchange ratios. Before *Top Gun*, the Navy had been losing one plane for every three it shot down; after *Top Gun* training, the ratio improved to as high as 13 to 1. Significantly, the Air Force, which had had a similar kill ratio and at that time had no program equivalent to *Top Gun*, did not improve its score in the Vietnam air battles.

In actual warfare, of course, all branches of the military work in conjunction with the Pentagon. In this building there is a place that controls all the gaming that is conducted by the military. This place is called SAGA.

In the bowels of the Pentagon, down 65 concrete steps and behind a computer-locked vault door, lies the Studies Analysis and Gaming Agency (SAGA). This unit forms part of the Office of the Joint Chiefs of Staff and in fact is at the head of military gaming. Just as the Pentagon directs all other military activities, so it determines the amount and direction of wargaming. Its instrument is SAGA, under orders from the Joint Chiefs and the secretary of defense. SAGA (recently renamed the Strategic Analysis Division) manages the externally contracted gaming program, keeps track of all simulations used in the military, performs systems analysis studies for the Chiefs, and conducts games of its own among the armed services and civilian leadership.

The story of SAGA goes back to the Eisenhower administration. Studies of the strategic balance by interagency working groups and panels of outside consultants seemed consistently to emphasize a Soviet threat, which the President himself viewed with more equanimity. He admitted ruefully to his special assistant for national security in 1959 that he had become "allergic" to such panel reports. Part of the problem was the difficulty inherent in defining scenarios and devising methods of calculation for results in the studies, which in turn led to pressure for the total elimination of the use of wargames.

The conclusion of a 1959–1960 panel study was

that simulation procedures should be regularized rather than eliminated. On January 5, 1961, shortly before the Kennedy administration entered office, the Joint Chiefs ordered the director of their joint staff to create a group for this purpose. Thus were wargames institutionalized at the Pentagon. In several bureaucratic incarnations, the games group increased to a strength of 42 officers and 3 civilians and assumed the shape it retains today.

A SAGA activity that clearly demonstrates the postwar explosion in wargaming is the compilation and periodic updating of a catalog of military simulation models. This document details the users, creators, contents, computer requirements, and status of wargames used by the military. In fact, a Soviet military attaché in Washington, Lieutenant Colonel Yuri P. Leonov, who was arrested in August 1983 had, among other things, allegedly sought a copy of the SAGA wargames catalog. This document, which by the early 1970s had identified 190 simulations in military use, contained almost 330 entries in its 1983 edition.

Despite its responsibilities for managing the wargaming program, SAGA's influence has been restricted to narrow and technical issues. Its function is to create a unified theory of military gaming, but its power never extends beyond the theoretical. It cannot eliminate systems that simply do not work—they remain in the hands of the Pentagon bureaucrats.

The Pentagon wargaming budget demonstrates this fact. There are probably 800 to 1000 full-time professional wargamers among the military, including SAGA, the armed services, and personnel assigned to NATO. Salary costs alone amount to over $25 million a year. In addition, SAGA administers several million dollars a year in contractor efforts from "think tanks," with equal if not larger programs under the Office of the Secretary of Defense. The services also contract wargames independently through their own systems analysis staffs or agencies. Based on the available wargame costing data, these assorted programs may add up to as much as $100 million annually.

Within the defense budget category known as "operations and maintenance" lie the special costs for field exercises and military maneuvers. The Army's national training center alone costs $110 million to operate; the other services have their own similar "electronic battlefields." In addition, the Joint Chiefs have a contingency fund for military exercises, which expended, for example, over $200 million during 1983 for such maneuvers as *Bright Star* in Egypt and Somalia, *Big Pine* in Honduras, and those regularly conducted by NATO. Finally within the defense budget for "procurement" are hundreds of millions of dollars spent each year for simulators that train men to use various complex pieces of equipment.

A ballpark figure might be that the national defense gaming effort easily costs over a billion dollars a year. But this expenditure is a small part of our defense budget, and the allocations are not to a consolidated group—they are scattered through joint, service, and weapons system budgets. Ironically, even though it is at the apex of Pentagon wargaming, SAGA bears responsibility for only a tiny proportion of these funds and has no approval authority over programs initiated outside the agency. Indeed, when asked, SAGA officials could not even cite a figure for the overall Pentagon wargame budget. The formal responsibility that SAGA does have, which is to ensure quality of simulation models, is thus vitiated by its inability to terminate bad programs or reinforce good ones through budgetary controls.

Since World War II, wargaming methods have assumed a growing influence in the United States military, extending to each branch of the armed services as well as the entire Department of Defense. The computerization of simulations has offered new possibilities for both the application of wargame models and the operation of games and military maneuvers. The innovation of the computer made it practicable to determine, with chilling precision, the number of men and supplies necessary to destroy the enemy's men and supplies. At the level of military maneuvers, the awesome speed and rigorous consistency of the computer, combined with the information transmission capacity of electronics, hinted that tactics could be simulated on a mock battlefield with something approaching realistic field conditions.

It was also important that wargame methods seemed to military men to have been useful in their World War II experience. They supported the postwar explosion in wargames and the use of military maneuvers as training, to the point where hundreds of millions of dollars are spent each year on this activity. In turn, the costs of a wargame have increased greatly as sophisticated and expensive machines become essential to the wargame model. Despite the rising cost of wargames, the Pentagon has only a central mechanism to oversee the quality of models but none for budgetary accountability.

By the early 1980s over 300 wargame models were in active use in the military.

What can one say about all this gaming? When Robert McNamara was asked the same question in 1978, he replied, "I know I have a reputation for emphasis on quantification, perhaps excessive quantification. But I myself have never believed in the automatic application of mathematical formulae to events that depend on poorly understood relationships between human beings. It is almost impossible to develop factors that properly express such relationships."

As secretary of defense McNamara had dealt with the numbers, the real military numbers, for seven years during a key period of the 1960s, the very time in which wargaming was institutionalized in SAGA. His doubts point up the entire question of the relationship between simulation models and real-world conflicts. This is a serious but poorly understood problem, the complexity of which is vividly illustrated by a look at some of our most important wargames—simulations of nuclear warfare.

CHAPTER 3

WHEN THE UNTHINKABLE BECOMES PLAYABLE

There is an old saying that generals always prepare to fight the last war. But no one can prepare for nuclear war in "last war" terms since there has never been one. Experience counts for very little in nuclear warfare, given the immense power of the weapons that would be used, and experience cannot even be developed without having the nuclear war that policy is designed to prevent. These facts have not prevented military thinkers from attempting to understand nuclear weapons and warfare better, however, and wargames—maneuvers as well as simulations—have played a special role in the effort to learn more. Each day the unthinkable is played out in the military's gaming rooms and exercise fields around the world.

The age of nuclear weapons began over Hiroshima and Nagasaki in 1945, but the initial use of nuclear weapons involved isolated cases in which the enemy was surprised through the use of new technology. Hiroshima and Nagasaki did not make World War II a nuclear conflict in which weapons of this sort would be widely used for a variety of purposes, and they did not provide experience in the day-to-day and minute-to-minute conduct of nuclear warfare.

However, both Japanese cities were studied intensively after the war. In addition, in the Pacific Ocean beginning in 1946 and at a Nevada test site beginning in 1951, the United States carried out many experimental atomic and thermonuclear detonations. These were atmospheric tests until the Partial Test Ban Treaty of 1963 required that all nuclear testing be moved underground. (Altogether there have been almost 800 American nuclear tests, more than half of them underground.) Our testing and our studies of the Japanese cities have given us a body of knowledge regarding weapon effects but, still, no real experience in the conduct of nuclear warfare.

Although hardly imaginable today, the military did carry out field maneuvers in conjunction with atomic bomb tests at the Nevada site between 1951 and 1957. But these too generated little genuine nuclear field experience. The test site was essentially a laboratory experimenting with different nuclear devices; most of the atomic "shots" did not use off-the-shelf weapons but rather experimental munitions that could, and sometimes did, perform much differently from pretest paper calculations. Practices at the site also restricted the realism of the maneuvers. Soldiers did not exercise on an integrated nuclear battlefield; they observed atomic tests and then simulated combat. It was as if the troops were being asked to maneuver in the presence of nuclear weapons as an affirmation that the nuclear genie had not yet robbed warfare of its traditional meaning.

The first nuclear maneuver is a good illustration of this artificiality. It was carried out on November 5, 1951, having been planned by a staff under Lieutenant General Joseph Swing. The scenario assumed that Aggressor had invaded the United

States and held the region west and north of the test site. A nuclear attack was to be made to break the Aggressor front line, after which troops of the 11th Airborne Division would advance toward the "designated ground zero," the location of the blast. Some 833 paratroopers in a battalion combat team occupied trenches just 2 miles from ground zero while another 4300 observers and test site personnel were stationed farther back. Radiation monitors moved out to check contamination levels a half hour after the detonation. The paratroopers, beginning their advance 15 minutes later, marched to within 900 yards of the blast point and practiced standard tactical maneuvers just 2½ hours after the explosion[1]

Two other nuclear "shots" in the 1951 series were also observed by ground troops. Altogether 7200 Army soldiers witnessed one or more of the tests. A variety of checks were run on various types of equipment deliberately left in the open at different distances from ground zero. The military conclusion drawn from the 1951 series was that troops who were dispersed and well dug in could survive a nuclear blast in sufficient strength to retain their combat capability.

Atomic maneuvers in subsequent years led to similar results. But the conclusions were of limited value due to the very necessary safety factors routinely followed at the Nevada "laboratory." For example, troops were warned before a shot, and trenches and bunkers were always available within which to take cover. This would certainly not always be the case on a battlefield. Worse, only one field maneuver utilized the basic organization the Army intended to use on the nuclear battlefield. Carried out in conjunction with the "Smokey" shot in 1957, the maneuver was even more artificial than usual because it was being filmed for television—a segment of the Army's documentary show of that era, *The Big Picture*—and because "Smokey" also featured an extensive civil defense experiment on weapon effects against an "average" American town.

Difficulties arose from the natural tendency to focus on the more immediate and apparent blast effects of nuclear weapons. Radiation was not visible and was not well understood. Most of the attention was paid to immediate radioactive effects (scientists ignored the entire category of low-level ionizing radiation). Even the Joint Chiefs of Staff when queried by the commander of NATO forces in 1954, admitted that the effects of radiation were mostly unknown.

So the experience gained from these tests and exercises remained quite limited. And some of the experience may have been misleading. This was the case in a 1955 maneuver in which armored corps officers sought to demonstrate that their branch had special viability on the nuclear battlefield. The maneuver took place during the "Apple II" shot on April 26, 1955. For the exercise a composite "Task Force Razor" made a 160-mile road march across the Mojave Desert from Fort Irwin, with 238 tanks, vehicles, and self-propelled guns. They arrived at the test site the night before the shot, then commenced a mass attack on ground zero at dawn. The concept was not unlike that of a cavalry charge, and indeed the tank commanders pressed their advance very close to ground zero, breaking off only when radiometers inside the tanks registered very high levels. But already conceived in 1955, and soon to be on weaponeers' drawing boards, was the neutron bomb, a kind of nuclear weapon designed to minimize destruction and maximize radiation effects. Had Task Force Razor been operating against a weapon of this sort, it would have been employing exactly the *wrong* tactics—advancing toward a dense and lethal radiation source.

More immediate questions of safety arose during 1957 atomic maneuvers. Several men were apparently injured by blast effects when the nuclear shot "Hood" produced substantially more explosive power than expected. The casualties were among a 2100-man provisional brigade drawn from the 2nd Marine Division. The exercise staff then canceled the planned field operations. At 74 kilotons (a kiloton is the equivalent of 1000 tons of TNT), shot "Hood" still stands as the largest nuclear weapon ever detonated in the atmosphere within the continental United States.

The 1957 exercises were the last atomic maneuvers. A superpower moratorium on nuclear testing began the following year. It resumed in 1961–1962 but was then moved underground by the Partial Test Ban Treaty. Once testing went underground, it became impossible to gather further data on the atmospheric and radioelectronic effects of nuclear weapons, and since then weapons technology has been moving in a direction, with the adoption of microcircuitry and sophisticated electronics, that makes it ever more susceptible to nuclear effects. As a result, much of the mechanical experience gained in the atomic maneuvers has become outdated.

Thus the sum total of our experience with the combat effects of nuclear weapons is no more than

the knowledge gained from a series of maneuvers conducted during the 1950s. The knowledge gained from the results of these tests is almost as artificial as the language in this Marine Corps critique of the 1955 maneuvers. "The artificialities necessary because of the restrictions imposed in an operation of this type precluded full pursuit of the objective of further evaluating and developing tactics." As for nuclear strategies, these were more properly the province of board and computerized wargames than the battlefield maneuver. But strategic nuclear simulations had their problems as well.

Much of the credit for the innovation of board or computer nuclear wargames must go to the Rand Corporation. At Rand's Social Sciences Division, Hans Speier and Herbert Goldhamer presided over a multitude of experiments in modeling real-world events. As early as 1949, Goldhamer had created a game to simulate international crises, and soon afterwards the Redwood and Sierra series of games helped the military elaborate plans for the use of tactical nuclear weapons. But the first big strategic nuclear game was Rand's *Air Battle Model*.

Initially *Air Battle Model* was a manual game, played by hand on a huge map of the Soviet Union. Later it was adapted for use with a computer, and it eventually simulated air base activities (including launching, flying, and refueling planes), defense reactions, and penetration to targets. The two basic outputs of the wargame were an estimate of the damage results and a set of "histories" of each hypothetical bomber unit and how it performed in the air offensive.

The Air Force was very happy with Rand's *Air Battle Model* and later built a staff division at headquarters specifically to work with this wargame. When the Air Force took *Air Battle Model* to the Pentagon, it added more "bells and whistles" to it. The game ultimately operated up to 25,000 aircraft (3000 of them simultaneously in flight), 1000 offensive bases, 1500 defensive ones, an equal number of warning radars, and 3500 targets; there could be 31 bomb types in any one game, carried aboard 30 different kinds of planes! But where a computer needed about six hours to play through 2½ days of "real time" in the Rand wargame, the same computer using the Air Force version required 30 hours to game one day's real time.

Needless to say, the manual edition of *Air Battle Model* took even longer to play, an entire summer in the case of the "net estimate" (to be described shortly). Yet this particular setup of the Rand game furnishes one of the best illustrations of the capabilities and limitations of nuclear simulations. The wargame occurred during the course of an "integrated evaluation" of a hypothetical nuclear war called a "net estimate" and ordered by President Dwight D. Eisenhower in early 1955.

The net estimate was intended to assess the possible results of a war three years into the future under several alternative scenarios. The first was a surprise attack in which the United States had no warning of impending hostilities. The second contingency was "an initial attack . . . preceded by the amount of strategic warning estimated to be most likely." A final scenario covered the possibility that the United States might have sufficient warning time to bring nuclear forces to a state of alert. For each scenario the net estimate was to calculate the effect and extent of direct damage, including radioactive fallout, "resulting from the most probable types and weights of attacks which the USSR is capable of delivering during approximately the first thirty days of general war, taking into account the effect of U. S. counterattacks during this period."

An assessment like the 1955 net estimate clearly implied the need to analyze a huge mass of data. The Net Evaluation Subcommittee, which Eisenhower established to conduct the study, soon agreed to use a wargame as its tool, and Rand's *Air Battle Model* was selected. For the purpose of the net estimate Rand added a huge mapboard representing the United States plus units to represent Soviet offensive forces and American defensive ones. The three scenarios were respectively designated plans A, B, and C. The wargame was played throughout the hot Alabama summer of 1955 at the Air War College, on Maxwell Air Force Base outside Montgomery.

Two teams played this wargame. Red players commanded the hypothetical Soviet forces, a senior leader assigned subordinates to handle different components of the Red forces. The blue team was structured in the same fashion. Rand experts and some Pentagon personnel umpired the simulation. But the game took so long to play that eventually only one of the scenarios was completed; no results for the others were extrapolated from the available data.

The wargame revealed significant gaps in the coverage provided by the design. For example, a vital factor in determining the strength of the red attack was the availability of Soviet air bases north of the Arctic Circle at which bomber units could refuel. Meanwhile, a standard U. S. Navy wartime

contingency plan was to use aircraft carriers to bomb these bases. The red team decided to attack blue aircraft carriers at sea in advance of the main offensive, but then it turned out that the wargame had no model for simulating aircraft carrier discovery and losses. Navy representatives at the game refused to accept any of the suggested methods for calculating carrier attrition until, halfway through the game, the chief umpire arbitrarily ruled that 8 of the 15 blue carriers had been sunk.' Naval officers resented this ruling, arguing that the Rand experts had played an excessive role in the wargame. During preparations for the next year's net estimate wargame, one officer wrote the chairman, "unfortunately and as a result of last year's game, 'war gaming' has been given a bad name.'

President Eisenhower was perhaps unaware of these objections. The results of the net estimate had already gone to him on January 23, 1956. According to the President, this was the outcome of plan A:

> The United States experienced practically total economic collapse, which could not be restored to any kind of operative conditions in under six months to one year. Members of the Federal government were wiped out and a new government had to be improvised by the states. Casualties were enormous. It was calculated that something on the order of 65% of the population would require some kind of medical care, and in most cases, [would have] no opportunity whatsoever to get it.
>
> The limiting factor on the damage inflicted was not so much our own defensive arrangements as the limitations on the Soviet stockpile of atomic weapons in the year 1958.

The calculations also projected damage to the Soviet Union up to three times greater than that to the United States. The alternative scenarios showed no significant difference in American losses. Eisenhower appreciated the report, writing that it was "the most comprehensive and valuable one on the subject yet presented." But given the gaps in simulation coverage, the 1955 wargame shows that senior government officials are sometimes not equipped to interpret the faults in games and thus can be misled by wargame outcomes.

At times nuclear wargames have uncovered faults in arrangements with military allies, but they have also led to political difficulties within the Western alliance. This was the case with *Black Rock*, a month-long worldwide rehearsal of U.S. war plans conducted in 1960. That simulation included high-level official participation. President Eisenhower, for example, was evacuated from the White House to a secret underground command post for a meeting with his Joint Chiefs of Staff. (It was during this wargame, in fact, that the United States learned its U-2 spy plane, piloted by Francis Gary Powers, had been shot down over Russia, and the hypothetical crisis almost became a real one.) The *Black Rock* simulation also included a number of war readiness alerts at key air bases. Two such alerts were ordered at bases in England. However, it turned out that the British, who were supposed to make joint decisions on nuclear matters with the United States, had not even been consulted on the alerts. Moreover, it was discovered that no procedure existed for informing the British government of alerts ordered by U.S. authorities at jointly operated bases. These deficiencies were remedied by a revised instruction issued by the Joint Chiefs of Staff two months later.

Like the net estimate, the NATO exercise *Carte Blanche*, held the same year, involved a manual wargame played on a tabletop at NATO headquarters, while certain moves were associated with troop maneuvers in the field. The embarrassment then was the reaction of Western European public opinion when, at the end of the wargame, the NATO command announced that some 335 hypothetical tactical nuclear weapons had been used against military targets but nonetheless resulted in an estimated 1.7 million people killed and 3.5 million injured by blast effects alone. A public uproar followed, particularly in West German parliamentary debates.

Beyond the diplomatic difficulties that may arise from wargames are the sheer complexities of simulating nuclear warfare. The United States apportions the major responsibilities in this area between the Pentagon office that became the Studies Analysis and Gaming Agency (SAGA) and the Air Force's Strategic Air Command.

With headquarters at Omaha, the Strategic Air Command assembles the U.S. war plan, which is called the Single Integrated Operations Plan (SIOP). But in the nuclear age, no offensive plan can ignore the impact of adversary countermeasures. Since, of course, American planners had no access to Soviet war plans, it became necessary to formulate a surrogate Soviet plan. SAGA maintains a unit called the Red Planning Board for this purpose. Members are to think like Russians and draft a hypothetical Red Integrated Strategic Offensive Plan (RISOP). The RISOP and SIOP plans are then

played out against each other in simulations using SAGA computers.

This annual wargame remained a closely held secret until 1967, when Robert McNamara revealed in public Senate testimony that the Pentagon used actual "teams" to play out the SIOP each year. But the teams engage in very little "play" in these wargames, since both RISOP and SIOP are executed electronically by the computer.

Despite its precision and speed, the computer relies on the quality of the simulation models fed into it, and the models in turn rely on our inadequate knowledge of nuclear warfare, plus our available intelligence information on Soviet strategic forces. Thus the assumptions made by a model and its data base are a vital determinant of wargame results.

An excellent illustration of the impact of assumptions, in this case concerning military intelligence, occurred in 1969 during the debate over deployment of ballistic missile defenses. Officials claimed that a particular Soviet missile called the SS-9 was a near-term threat to the survivability of our Minuteman missile force, 95 percent of which could be wiped out by the SS-9 according to the Pentagon projections. But the Pentagon projections, derived from wargames and intelligence estimates, hinged on assumptions regarding the accuracy and mechanical reliability of the Soviet missiles. These assumptions were attacked by defense analysts in congressional hearings and in the press. Indeed, computer simulation using only slightly different assumptions leads to significantly changed results. For example, if SS-9 missiles were roughly half a mile less accurate than postulated by the Pentagon, fully 60 percent of the Minuteman force would have survived the attack.

At the North American Aerospace Defense Command (NORAD), the wargaming division predates the formation of the command, and NORAD games during the late 1960s were used to test the capabilities of missile defenses. But one NORAD gaming exercise on November 3, 1979, actually caused a false nuclear alert. Technicians at the Cheyenne Mountain headquarters were preparing to run one of their wargames, setting up magnetic data tapes that would input the hypothetical enemy strike. Evidently the tape drive was inadvertently switched into the active warning net and showed up on NORAD monitors as an incoming missile attack. This quickly led to a high-level "threat assessment conference," which fortunately discovered the error.

Predating the now controversial "Star Wars" program, the Aerospace Corporation designed a space wargame for NORAD in the mid-1970s that could be played on an IBM 370/155 computer. This simulation provided for 112 satellites assigned to two teams. Later, prompted by fears of hostile interference with American satellites, Martin Marietta was hired to augment the wargame with provisions for electronic countermeasures and defenses against laser "blinding." It is likely, however, that such space games will be transferred from NORAD to the recently formed Space Command.

The great advantage of wargames in the study of nuclear warfare is that they can be used to ask the kinds of "what if" questions that are inescapable when our knowledge is imperfect and incomplete. Since the wargame also does not involve actual hostilities, it can be run again and again to look at different aspects of the problem. However, wargames based on simulation models are also at a grave disadvantage when confronted with questions of nuclear warfare, since it is not likely that we can effectively simulate a phenomenon that we do not wholly understand in the first place. Though this dilemma exists in all wargames, it is especially acute in simulations of nuclear war.

Still, the unthinkable has become the playable, and perhaps the possible, in our nuclear age. And none of the weaknesses inherent in wargames, or the special problems entailed in nuclear simulations, has prevented the proliferation of these models. In fact, SAGA in 1975 cited some 46 nuclear warfare wargames then in use by the Pentagon. No doubt the number has risen since then.

Nuclear wargames can be valuable in allowing analysts to ask questions about this kind of warfare, but their value should not lead us to ignore their limitations. We have seen that some simulations did not cover all the necessary types of activity, such as the net estimate wargame that neglected aircraft carriers, and others have caused political or diplomatic problems for the Western alliance. Most important of all are the sheer complexities of simulating nuclear warfare. Our experience in nuclear matters is mostly experimental, with the sum total of our knowledge derived from a very few outdated maneuvers conducted during the 1950s. This opens up the problem of the quantifications necessary in wargaming, which must be especially suspect in the case of nuclear games but are endemic to all types. Quantification in combat simulation is a key problem to which we now turn.

GAME **1**

PENTAGON: Monopoly in the Military

It is fun to rack up big budgets for your side in a game. In this game, however, you have to do some logrolling with the other players if you really want to win, cooperation mixed with competition. This is in fact how defense politics works at the Pentagon and on Capitol Hill. Leading the pack can be dangerous because the centers of power are suspicious of each other and especially of a front-runner. Cooperation creates reservoirs of goodwill for the day your service budget is on the table with the Joint Chiefs, the Executive, or Congress.

Pentagon is not a simulation in the formal sense of the word. The events in the game are intended to be illustrative and the decisions fictitious, woven from the progress of play. But by giving the players incentives both to compete and to cooperate, the game does simulate bureaucratic politics. And the content of bureaucratic politics is similar in tone and substance to real debates over military budgets. *Pentagon* shows how political factors influence the shape of budgets before the bureaucracy even gets down to decisions on weapons procurement and their merits.

HOW THE GAME WORKS

Each player of *Pentagon* represents one of the armed services: Army, Navy, Air Force, and to the extent that the roles and missions of the Marine Corps differ from those of the Navy, the Marines. Although four players are a good number to have in *Pentagon*, any number can participate in the game by thinking up names for the additional armed services that players will represent.

Pentagon is played on the game board that is printed on a fold-out sheet in the middle of this book. The board is divided into squares, and players circuit the board in racetrack fashion. In each square on which they land, players follow instructions to add or subtract amounts of money from their program requests for the annual budget. When a player lands on or passes the square marked "Appropriation," the amount he has accumulated in his requests is the approved "budget" for his service. This amount is then added to the player's score for winning the game. The player who has chosen to play the Air Force takes the first turn. Players then move in a clockwise order of play.

Each circuit around the board represents one complete budget cycle. Since presidential terms last four years, the play of *Pentagon* continues for four complete budget cycles. When all players' tokens have completed the fourth pass around the board, the game is ended. The player with the highest total from his four approved budgets is the winner.

Pencil and paper will be needed to keep track of budget money. Two six-sided dice, each of a different color, will also be required. One die is used to roll for movement around the board; both dice are used to roll for "revelation" random events, for

budget "program objectives" and for the results of congressional "testimony."

In certain instances, *Pentagon* requires a dice roll in the base 6 number system. This is why the six-sided dice should be in different colors. When using the base 6 number system, one die is designated to generate the "tens" number, the second die indicates the "ones" number. Thus if using a red die for "tens" and a white for "ones," a dice roll of red 5 and white 3 equals 53. A roll of 6 on either of the dice equals zero (0) for *that* digit. Disregard the colors of the dice when rolling in the usual base 10 system, and simply add up the numbers on the two dice to derive the result.

Pentagon is a fast game of give-and-take. A full play of the game can be completed in an hour or two.

Movement

Players move by turns, and play proceeds clockwise around the board, with each player taking his full turn before the next player begins his. Each space (hereafter called a "square," although actual shapes differ) counts as one (1) for movement purposes. Players may not skip squares as they move around the board. The amount of movement allowed varies from turn to turn and is established by the roll of a single die. The player moves his token along the track the number of squares indicated on the die and follows the instructions contained on the square on which he lands. The next player then takes his turn. Players continue taking turns in sequence until the last player's token lands on or passes the square marked "Appropriation" for the fourth time. This ends the game.

Squares

Each player represents a military service and attempts to maximize the amount of money his service receives in each budget cycle. All squares on the board add to, subtract from, or otherwise affect the player's budget request. There are several generic *types* of squares, as detailed below.

Automatic Effect Squares. There are two squares on the board that automatically affect the player *regardless of whether he lands on them or merely passes them* during movement. One is the "Appropriation" square. Each time the player passes this square, Congress is considered to have approved the budget for his service. The amount approved equals the current total of the player's request as determined by game action. The "Appropriation" square is also the starting point for the game, and all players' tokens begin the game on this square. On the second automatic effect square, higher authority (the secretary of defense, or "SecDef" on the game board) sets budget *limits* for the service. When a player lands on *or passes* this square, he must roll two dice, each of a different color. The result (in the base 6 number system) is the total amount the service is allowed for "program objectives." This number becomes relevant when the player lands on certain squares called "approval squares."

Approval Squares. There are three "approval squares," one each for the secretary of defense, the president, and the congressional committee. On each of these squares the service budget is considered to be reviewed by civilian authorities. If a player lands on the square, he must compare the current total of his accumulated budget requests with the number established by the dice roll for secretary of defense program objectives. If the player's accumulated requests total more than the program objectives, the request amount must be reduced to the program objectives figure. If the player's current total request is less than the program objectives figure, there is no effect.

Revelation Squares. There are five "revelation squares." These represent extraordinary events that affect military budget making. Each time a player lands on one of these squares, he must roll two dice to discover which of the revelations will affect him. The dice result (in base 6) is the number of the revelation that will apply. There is a separate Revelations Detail Sheet that supplies 35 different events corresponding to the possible dice rolls. The player follows the instructions for the revelation he has rolled.

Standard Squares. The board contains a number of uncolored "standard squares." These squares simply instruct the player to add or subtract from his budget requests or to back up a square on the board. The player follows the instructions on the square on which he lands.

Chiefs' Meeting Squares. There are five squares that represent meetings of the Joint Chiefs of Staff. Each player is a member of the Joint Chiefs as the senior officer of his military service. When the player lands on a "Chiefs' Meeting" square, a de-

cision by all the players acting together is required. Each square contains a notation of the topic of the meeting and the amount of the money request for addition to or subtraction from the budget. The player landing on the square "initiates" the meeting and argues for or against the indicated action; however, players may not vote on their own proposals. The other players then vote on the proposal; a majority vote wins and a tie vote loses.

Chiefs' meetings are a key instance in which the politics of *Pentagon* come into play. Viewed from a purely competitive standpoint, voting against the initiator of a Chiefs' meeting defeats the immediate request of that player. Cooperation, however, is often equally or more beneficial for the player's own interests than competition. The initiator of this turn's meeting will stand in judgment of the player's own requests on other turns, both in other Chiefs' meetings and when acting as congressional authority. Since players cannot vote on their own requests, they are completely dependent on the goodwill of other participants on those occasions.

Testimony Squares. There are three "testimony squares." Whenever a player lands on one of these squares, he is considered to be providing testimony before Congress. The player may choose whether to testify *in favor* of his own budget request or *against* the budget request of any other single player. Testimony concerns current budget requests only—that is, the amount of requests accumulated since the player last passed the "Appropriation" square.

When a player gives testimony, another player acts as congressional authority. At the beginning of the game the authority is the player who will move *last* (that is, the person sitting to the left of the Air Force player). The congressional authority shifts to another player *each time any* player's token passes the "Appropriation" square. Authority shifts to the *left* in a counterclockwise direction and continues to shift as often as tokens pass "Appropriation." The role of the congressional authority is to judge the testimony presented by players.

The congressional authority considers whatever statement the player made in testimony. At the authority's sole discretion, he decides whether a given statement is justified. The congressional authority must declare whether he accepts the player's testimony and, at his option, may state the reasons for his decision.

If the player has testified in favor of his own budget request and the congressional authority accepts the argument or if the authority rejects an argument favoring reduction of another player's budget, no further action is necessary, and play proceeds to the next person's turn. If the authority decides to accept an argument for reducing a player's request or rejects the testimony of a player in favor of his own budget, a dice roll determines the final effect. In this case the congressional authority rolls two dice. The result of the dice roll in base 10 is the amount by which the budget request of the affected player is reduced. The game then proceeds to the next person's turn.

In presenting testimony to the congressional authority, the player cannot choose to comment concerning the budget requests of whichever player is currently serving as authority. In deciding the fate of testimony, the congressional authority himself should remember that his power in the game tends to be fleeting. It is quite likely that a future turn will find the current authority in the witness seat for testimony before a congressional authority who is the current witness.

Scoring and Winning the Game

As the player's token rounds the game board he adds to or subtracts from his prospective score according to the instructions for each square on which he lands. The squares give or take game dollars from the player's budget request. Each time the player's token lands on or passes the square marked "Appropriation," the amount of dollars currently in the budget request is considered approved by Congress and becomes part of the player's score for winning the game. Once the player has completed his first circuit of the board (budget cycle), his score will contain two kinds of "dollars": approved budgets and current budget requests. All game actions affect *only* current budget requests. The player continues to move his token around the game board until he has accumulated *four* approved budgets. At that time the total of all dollars in the four budgets equals the player's overall score for the game. The player with the highest score wins. Players should keep track of their scores with pencil and paper. A score sheet should have two columns. Use one column to record the total amount of each passed budget. Use the second column to carry the budget request account, adding to and subtracting from it as play proceeds around the board. To determine the winner in *Pentagon*, wait until all players have scored four approved budgets, then compare each player's total dollars.

REVELATION DETAIL SHEET
(Detach or photocopy this sheet for reference)

Base 6 number rolled	Meaning
00	Field exercises show poor readiness among combat units, increase operations and maintenance request $5 billion.
01	Systems analysis studies show a critical lack of the latest type weapons, add $10 billion to request
02	Consultants recommend procurement of additional precision-guided munitions, add $10 billion
03	Recent Middle East fighting reveals important faults in present weapons, fix them for $10 billion.
04	Budget surplus and healthy economy allow greater allocations to defense, add $5 billion
05	Crash of latest type of aircraft causes a flap, lose next turn finding out the details.
10	Congressional inability to pass last year's budget brings a continuing resolution, lose next turn
11	Congress cracks down after press reveals secret diversion of military funds to a prohibited covert action program, lose $10 billion
12	Opponents slip derogatory information on service performance to secretary of defense, lose next turn briefing him
13	Repeated failure of latest weapon in tests prompts a presidential budget review, lose $10 billion
14	Congress conducts investigation of questionable procurement practices, lose one turn on Capitol Hill
15	Another service has the ear of Congress, lose $5 billion
20	Long-planned field exercises result in complete command muddle, lose next turn explaining to service secretary
21	Congress cuts funds after investigative report reveals collusion between military and industry in granting new contracts, lose $10 billion
22	Secretary of defense shifts money from Pentagon-initiated wargame studies into funding combat forces, add $5 billion.
23	Top-secret commando raid fails spectacularly, lose the next two turns in total disarray
24	Careful testing shows new weapon to be totally useless, secretary of defense deletes program for $10 billion
25	New urgency in defense budget planning, advance immediately to next Joint Chiefs of Staff meeting square

REVELATION DETAIL SHEET *(cont.)*
(Detach or photocopy this sheet for reference)

Base 6 number rolled	Meaning
30	Additional spare parts found necessary for many service weapons systems, add $10 billion
31	President decides on military intervention in a Caribbean nation, lose next turn planning invasion
32	Congress receives independent study demonstrating service "threat assessments" to be exaggerated, cuts $10 billion
33	President determines to submit next year's budget request early, advance to next "approval" square
34	Technological breakthrough to be exploited by new weapon system, add $10 billion
35	Service chief is required to attend annual politico-military "crisis simulation," lose next turn
40	Falling price of oil reduces operating costs, lose $5 billion
41	Cost overruns in newest high-performance weapon results in "stretching out" procurement, reduce request by $10 billion
42	General Accounting Office report discovers irregularities in administration of military bases, advance to the next "Testimony" square
43	NATO maneuvers demonstrate need for more conventional forces, add $10 billion
44	Blue-ribbon panel recommends changes in military planning; lose next turn reviewing the proposals
45	Congress acts to reduce budget deficit by holding down defense spending, cut $15 billion
50	Foreign aid pinch leads president to divert some military funds, lose $5 billion
51	Service chiefs argue over military program, return to the last Joint Chiefs of Staff meeting square and re-argue issues
52	Disarmament agreement with main adversary reduces the military threat, cut $15 billion
53	Congress reverses priorities in favor of social programs, cuts back defense spending $15 billion
54	Public opposes excessive defense spending, Congress cuts your request by $10 billion
55	Service chiefs hassle to reach agreed position on arms control, lose next turn in meetings

Pentagon playing pieces

CHAPTER 4

WHAT DO WE KNOW ABOUT WAR?

If we do not pay attention to history, the saying goes, we are doomed to repeat it. Yet in dealing with the specific knowledge involved in wargames, the history of warfare tells us little of present or future conflicts. Since tactics, weapon strengths, and other concepts of the process of war are drawn from the past to form the basis for wargame models, a Pentagon gaming of a hypothetical present or future conflict is at best an extrapolation from the past. Under these conditions, the accuracy of data and the methods used in assembling the data in game models become the overriding factors in the value of simulation models. They determine, to a very great extent, what we know about war and, therefore, how to prepare for it.

Unfortunately, the limitations of data and method are not always taken into account when conflicts are modeled. Though simulations are used in a variety of ways in the Pentagon today, all too often this is done with no regard for the limitations of the method. Such fundamental studies as whether the nation has enough tanks, guns, and combat divisions may thus be hampered by our intellectual difficulties in understanding war. There are, for example, the inherent problems of quantifying intangibles such as morale and terrain and the validity of assumptions made in game models. Let us examine the nature of the wargame model and a most vital type of quantification—the values assigned to units in a wargame. Not only are the data softer than one might suppose, but some factors are difficult if not impossible to quantify, as will become clear from our discussion of troop morale and combat doctrine. Wargames specifically designed to work around these problems often produce a different set of difficulties. The basic problem is that we simply do not know enough about warfare.

The construction of a simulation model is fundamental to all wargames. The model is an abstraction of reality. It is analogous to the concept in biology of the human body as being composed of a number of "systems," such as the respiratory system and the cardiovascular system. This biological abstraction explains the operation of the human body by breaking down the totality of the being into a set of elements that govern each biological function.

Similarly, a wargame model mimics the process of warfare, the "systems" are functional equivalents of real-world elements that influence the outcomes of war. Designing the model is choosing the set of elements to cast as systems in the wargame according to some concept of the process of war. Typically, a wargame includes systems governing the amount of information players will have, the movement of forces, combat interactions among forces, the method of controlling forces, and the capabilities of military units. The progression from "war chess" to the *Kriegspiel* was significant precisely because the wargame models were becoming more sophisticated. As wargames started to mimic

warfare, users began to talk of "simulating" warfare and of the quality of realism in the simulations.

Quantification assumes a central role once simulation becomes the object of the game because of the absolute necessity of translating military units and capabilities into specific values and functions. In a field maneuver, the troops involved provide a rough quantification themselves, but in all other wargames, quantification is a matter of intellectual choice and further depends on input data that may or may not qualify as scientifically "objective." The difficulty in determining the "firepower" of a military unit is a classic illustration of this problem.

What distinguishes wargames from other kinds of simulations is their purpose in mimicking conflict. Units in such a game must be able to make precise combat comparisons with each other and thus require relative combat values. Combat value is most often derived from an assessment of the firepower of the unit's equipment. Firepower, according to the Joint Chiefs of Staff, is "the amount of fire that may be delivered by a position, unit, or weapon system." Such a definition implies a numerical content, a quantitative meaning. Yet a closer look at the measurement of firepower indicates a good deal of ambiguity in its definition.

Weapons of various types are the essential ingredients in firepower, however, an observer who sought the overall combat value of a military unit would need to go beyond individual weapons. Somehow the different capabilities of the weapons have to be integrated into a single index. This process is inherently complex because different weapons may not be strictly comparable. For example, nuclear weapons inflict damage through blast effects, concussion effects, or prompt and residual radiation. Artillery and mortar shells cause damage through blast, concussion, and fragmentation only. A bullet wounds through direct impact. Such differences in physical principles constitute a first obstacle to aggregating wargame unit values.

The individual firepower of a weapon is most commonly determined through tests on a proving ground. Tests are conducted with many classes of target and under many kinds of conditions to establish the "lethality" of the weapon. Still, the proving ground is basically a field laboratory; performance in the lab can be much different from that on the battlefield under combat conditions. Moreover, because testing is time-consuming and expensive, it is impossible to hold new tests each time some new data are needed. Existing test results are often adapted or extracted for purposes much different from those intended.

Another problem is that weapons are tested in isolation but operate together. Ground forces consist not of individual soldiers but of units, from an infantry fire team with three to five men to a division of perhaps 17,000. For every type and level of unit the Army has a "table of organization and equipment" (TOE) that specifies numbers of men and numbers and types of equipment. The method of aggregation used to calculate unit values in a wargame is to multiply the lethality of the weapons by the numbers of them assigned in the TOE. But results from the different weapons are merely added together for the total score. Thus some transformation is needed in assembling the quantification of the firepower.

Calculation seems even more difficult once we begin to factor in certain real-world features. For example, an explosive shell retains roughly the same power regardless of the target distance, whereas the lethality of a solid shot drops radically as distance to the target increases. Consider the relative values of a tank battalion that has many explosive weapons (cannon) against a mechanized infantry battalion, which has more solid-shot-type weapons (small arms). The 1973 edition of the Army's manual *Maneuver Control* credits the tank battalion with a score of 2843 at a range of 300 meters and 2083 at 1000 meters. By contrast, the mechanized battalion is given 3346 at the 300-meter mark and 1792 at the longer range. At 300 meters the mechanized battalion has been given a significantly higher value despite the known greater lethality of the cannon on the tanks! The firepower scores at 1000 meters are more like what we might expect, but the first set of values suggests that something more than raw firepower was involved in the calculation.

There are also assumptions that are implicit but never stated in a firepower score. One is that unit TOEs are uniform, which is often not the case—combat formations may have detached component units, and they can be below the assigned strength or even overstrength. Another assumption is that equipment always works and that weapons always produce firepower equal to the laboratory values given them. In these paper calculations, the equipment never wears out, shells are never "duds," and there are no misfires, all conditions that cannot be expected in the real world.

An even more critical assumption is that forces have perfect supplies of all sorts of ammunition

The Army makes its plans for ammunition consumption using a concept known as "basic load," whereby each basic load equals one day's ammunition for all weapons of the unit. A certain amount of this supply is factored into the firepower score, but although the planning figures for basic load are drawn from real wartime experience, in all cases it is the experience of the *last* war. Thus World War II planning figures were outstripped by consumption in Korea, and Korean ones by consumption in Vietnam. For example, the basic load for a mechanized division defending a position for the first day was considered to be 835 tons in 1966 but was revised to 2180 tons in 1971. An armored division's basic load for the same circumstances was deemed to be 969 tons in 1966 but 2574 tons five years later. Real consumption ran at almost triple the planning figures! Because there is a direct relationship between ammunition expenditure and real firepower, these data suggest that military unit values should be constantly changing. But the firepower score for a unit is one value chosen at one point in time.

In the real world, deliveries of supplies are likely to vary from day to day and also to be subject to differing priorities, thus directly affecting unit firepower. In simulations, however, combat models often leave out supply factors entirely, something to be handled by a separate logistics game. Even where simulations do treat supply as an explicit factor, players' game actions can inject artificialities into the result. At Fort Sill, Oklahoma, for example, during the play of a simulation designed by the BDM Corporation, assigned supply rates were manipulated to favor a wargame test of the Multiple Launch Rocket System, which was in testing prior to the production decision. The Army had been impressed by the system's high rate of fire and thus its potential for halting Soviet armored advances. In the Fort Sill wargames, however, MLRS rapidly ran out of ammunition. A frustrated officer acting as umpire ordered the weapons to be allowed to fire anyway, with rockets brought up outside the supply network by means not modeled in the game. Interested analysts later calculated that the weight of rockets expended exceeded the capacity of the supply network that supports U.S. forces in central Europe.*

Another weakness in firepower scores lies in the way values of different weapons are aggregated. The scores are weighted in favor of weapons considered to be especially effective, yet here again the data change with experience. In the Mediterranean and northwestern Europe during World War II, over 60 percent of American battle deaths were caused by mortar and cannon shells, about 20 percent by small arms fire, and the remainder from bombs, grenades, mines, and traps. Given these data, firepower scores in the past tended to favor area-fire weapons such as cannon. However, studies of Chinese prisoners wounded in Korea revealed quite a different picture. Bombs and small arms inflicted a much higher proportion of the casualties. Similarly, the data from Vietnam show almost half of U.S. casualties from mines and booby traps, an equal number from small arms fire and grenades, but only about 10 percent due to area-fire weapons. Firepower scores built from the data of any of these wars would have proved completely inaccurate in the next one. So it is possible, even likely, that any score or scoring methodology may have incorrect foundations when applied to future warfare.

The firepower score emerges as a construct based on weighted assumptions, not an objective value. Despite its conceptual problems, this kind of intellectual construct is used as an input when gaming time arrives. In this way the firepower score, a surrogate for unit combat power, acquires some of the aura of a fact. Indeed, the assumptions built into the quantification influence the outcomes of wargames and, to the degree that simulation results are permitted to influence military policy, the contents of policies themselves.

Unfortunately, there are far more designers of wargames than analysts who understand the intricacies of notions like "firepower score." The BDM Corporation, which has done a good deal of ground warfare simulation, is a good example: In 1980 BDM employed about 1400 experts in various esoteric subjects. Yet when the time came to assign unit values for a NATO wargame, only one man was considered knowledgeable enough about firepower representation in games to be given the assignment.

Innovative designers have made efforts to bridge the gaps between the data and their use in simulations like that exemplified in the "firepower score" problem. *Tin Soldier*, a manual simulation designed by George Gamow at the Research Analysis Corporation between 1950 and 1952, focused on tactical combat, especially armored warfare, at the level of 200-man companies. *Tin Soldier* eventually made the transition to a computer-assisted game and finally became the fully automated simulation *Carmonette*. Instead of programming units to battle

each other, this game model provided for weapons to fight each other directly, simulating the physical principles involved and avoiding the need to posit firepower scores.

This kind of approach confronted the problem of accurate data directly and represented a major advance in simulation theory. But the innovation was outdistanced by improvements in technology. "Smart" weapons and improved explosives have given most combat arms much greater capacity to destroy any opposing arms. Tactical nuclear weapons are only one factor in this equation. At the opposite end of the spectrum, even infantry have a much increased capability against armor units due to precision-guided munitions, which exist in much greater numbers than the tanks in the opposing force. Weapon-antiweapon comparisons are increasingly vital considerations. In a wargame, however, every weapon must have some probabilistic ability to destroy every other weapon, and modeling *all* the interactions soon exceeds the physical limitations of simulation.

"Smart" weapons defeat the simulation process in another way. The advantage of simulations based on one weapon versus another is that they directly model physical processes—the ballistic trajectories of shells and bullets, for example. Smart weapons and other new technologies are manipulated by internal guidance or external command and no longer follow a simple path established at the time of firing. Simulations through pure physics become impossible; they must be overlaid by mechanics for determining the success of the internal systems or external control links (heat-seeking warheads, satellite- or radar-guided, etc.). When the simulation gets to that stage, it has reentered the realm of assumption through the back door.

Wargame designers have answered the new problems with the invention of "hierarchies" of simulations. These consist of a group of wargames. At the lowest level there might be a weapon-versus-weapon simulation, followed by one with small units, then additional wargames from operational scales to the theater level. "Hierarchies" of games sometimes feature parallel air warfare games to determine the extent of air support available for ground troops.

Hierarchies of games are influential, but they bear all the weaknesses of each component wargame. What is more, in a hierarchy the weaknesses of individual games are compounded because the results of the lower-level games are then used as inputs in the highly generalized simulations. Biases in any component wargame might thus drastically bias the overall result.

Another problem with simulation techniques is that they base game action exclusively on the attrition of opposing forces. Older wargames typically compared the firepower scores of units, calculated an outcome, and provided for losses and retreats by one or both sides. A new technique resulted from the application of quasi-mathematical models to ground warfare. Substituting mathematical equations for terrain maps in a wargame increased the feasibility of examining factors other than force size and the rate of arrival on a battlefield.

A primary feature of this style of wargaming is the mathematical treatment of the front line. In these simulations, the forward edge of the battle area becomes an abstraction, a line that may exist at a point in time but not necessarily in a space intersecting with rivers, roads, hills, and towns. Obviously, this kind of model contains hidden assumptions. The concept of maneuver is factored in while all remaining units simply "hold" the forward edge, advance or retreat is at a constant rate depending on strength, and units make perfect use of the equipment they possess.

Terrain representation is a special problem in this kind of simulation. A mathematical model may contain some provision for accounting for terrain, but who can know the exact mathematical meaning for warfare, of a given terrain type? Yet the outcomes generated are quite sensitive to small changes in the values imputed to terrain. This is particularly true of wargames that, to economize on computer time and data inputs, depart from the ideal of complete and detailed combat simulation.

Consider the case of urbanization and cities. This type of terrain is sure to figure in any real war along the NATO central front. Since 1945 the pace of urbanization in Europe has been rapid. There is now an additional ring of suburban districts around cities, plus a class of buildings (high rises) that would clearly have some impact on tactical fighting. World War II experience in urban combat has become outdated, with the proportion of European land area built to a high population density much greater than in 1945. A zone along the East German border, of about the length today's U.S. divisions could be expected to occupy, may contain as many as 85 villages. It has been said that "villages in Germany are only one kiloton apart," that is, a distance equal to the destructive reach of a one-kiloton tactical nuclear weapon. Populated locales plus wooded terrain, likely to be used as cover by

military units in any war, constitute about 60 percent of the division front. Despite these facts, little specific treatment of cities and urban areas is designed into modern wargames.

An appropriate illustration here is *Vector*, a weapon-versus-weapon simulation developed in the early 1970s for the Pentagon's Weapons Systems Evaluation Group by Vector Research Inc. In its initial version, containing 1265 pages of instructions, equations, descriptions, and scenarios, *Vector* had exactly four sentences regarding the effects of urbanization. This is typical of urban treatment in military simulations, and the treatment of other terrain types is similar.

Terrain is only one of the values affecting outcomes of war that is difficult to know. The degree of cohesion among individuals at the small-unit level is another. Also impossible to measure are the effects of leadership and morale. In addition, changes in military organization and technological developments have intensified modern conventional warfare beyond our formal experience. Losses of both sides during 18 days of the October 1973 war in the Middle East, for example, may have run as high as 3000 tanks, a similar number of armored personnel carriers, and 1100 guns. These losses far exceed those in any World War II campaign of equivalent length.

Some wargames try to get around the unknown factors by allowing the players to determine their own. This approach soon leads to biased gaming, misleading scenarios, and worst-case studies. In all other wargames the knowledge gaps are covered by assumptions, no doubt assuming that if it turns out to be wrong, the simulation model can always be corrected.

It used to be one of the big advantages of simulations that the conflict models could be readily adapted to incorporate new questions or data. Unfortunately, the cost of making changes rises with the sophistication of the wargame, astronomically when computers are involved. At the same time, a change in one aspect of a wargame model often has unintended (and unpredictable) effects on other elements of the situation.

The need for additional levels of design detail can almost always be found in analyzing game models, but the necessity of making the simulation "doable" forces the designers to choose between a workable game and a sufficiently detailed one. Amateur game hobbyists are quite familiar with this dilemma, which they debate as "playability" versus "realism." The same problem exists with Pentagon gaming. That the computer has not solved the uncertainties of military modeling shows that the problem is conceptual, not the result of the mechanisms by which we run wargames. With typical bureaucratic aplomb, a working group of the NATO Science Committee concluded in 1974 that "the classical trade-off between fidelity or detail of representation and model utility must be faced."

Wargame models follow notions of the process of war. Massive amounts of input data and many assumptions are necessary to construct them. The data, even where they seem "objective" at first, often turn out to be interwoven with more assumptions. Simulation techniques have become more sophisticated, but this raises new problems and often limits the effectiveness of the game model.

War is a complex phenomenon. The knowledge we have about it is an amalgam of historical experience, analysis, and conjecture. There is no single body of truth in our knowledge about war; instead we have a wide range of opinion, reflected in a lively defense policy debate. Historical experience provides a reference point from which theories can be built, while analysis allows us to postulate effects for various technological and political developments, and conjecture permits the application of these effects to the observable world.

But historical experience is limited: Tactical nuclear weapons have no record of employment in the role for which they are intended, and firepower scores weighted for the weapons of the last war may have little to do with lethality in the next one. Generations of equipment have changed as often as the organization of combat units—so often that they may bear little resemblance to those in use during the wars in which our limited experience was gained.

Analysis tries to pick up where experience leaves off. Wargames, mathematical formulae, statistical manipulation, systems analysis, and philosophical reflection have all been used in the effort to understand warfare. Wargames have played a valuable role in creating a form of experimentation, but that value is limited by the shortcomings of simulation models.

Certain difficulties are inherent in the thought processes behind the games. Selection of the *kind* of analysis to be applied to any given set of data is fraught with implications for the final conclusions. In the wargame the designer forms the model of a combat exchange by choosing the elements to portray and determining how game systems shall affect

the overall action. Just as thought processes differ so designers take different paths to simulation. We have seen attrition-based games, weapons-interaction simulations, and "hierarchies" of models. But the very elements of simulation may be mistaken, misleading, or inappropriate. As is said in computer programming, "Garbage in, garbage out." Analysis, like past experience, is a limited tool for understanding war.

Conjecture is the leap of faith that applies the results of analysis to the real world. Conjecture assumes a congruence between postulated and actual processes. In the case of a wargame, conjecture makes the assumption that the results of the model will be similar to those that might result from actual warfare. Of course, this is nothing more than a hypothesis.

We are hard-pressed to develop our understanding of war with only experience, analysis, and conjecture, yet they are all we have. Modern war is so complex, with so many interlinked facets, that our knowledge of it, our *real* knowledge, must remain incomplete and tentative. At the point of contact in the next war, along the forward edge of the battle area where armies and weapons will contest the outcome, the weight of the imponderables will be greater than that of the truly known facts.

GAME 2

THE R&D GAME: Congressional Chutes and Ladders

As *The R&D Game* shows, innovating a military program or a new weapon can be an extraordinarily lengthy and frustrating process. The concept behind any innovation is but a small first step. The program must be carried through the bureaucracy, receive the proper political imprimatur, and surmount its own technical hurdles. Perils lie at many places along the path, and because of the compromises involved in overcoming these various obstacles, innovations often reach the field with diluted qualities.

Simulations of the type we have been discussing have some utility in almost all the stages in the evolution of a program, stages that are shown as "frames" in *The R&D Game*. In conception, planning, design and testing, simulations help refine program goals and identify engineering choices. Simulations are especially useful in recognizing trade-offs in advance of program approvals, and their results may be of use in politicking Congress for appropriations or in investigations. Even at the deployment end, simulations can be used to train the soldiers, sailors, and airmen who will handle the new equipment.

The R&D Game is designed as a solitaire game. It is based on a decision-tree mechanism that leads the player through a set of alternative developments. This type of approach is sometimes called a "scripted role" model because the main emphasis is on broad decision choices rather than narrow selections of tactics. Given the broad choice, the decision tree itself generates much of the action, unlike a two-player or multiplayer game in which action flows from the decisions of each of the players. This kind of design approach is not often seen in Pentagon multiteam gaming, but it is much more common in simulations where the idea is to determine an optimal strategy through repeated plays. Typical examples of such one-sided situations are logistics games, command and control exercises, and certain nuclear force exchange models.

HOW THE GAME WORKS

The R&D Game is a conceptualization of the process of creating an idea and from that idea innovating a physical mechanism that assists large numbers of users. It could be any idea, requiring refinement, engineering plans, a proposal, and various approvals along with congressional appropriations for a government program. For the purpose of characterizing the stages in progression of the idea, I have used the analogy of the innovation of a new aircraft.

During each turn of this game, the player makes one of three possible choices on a frame of the game, then rolls two dice to determine the outcome of his decisions. Play of the game requires a photocopy of the Decision Results Table, pencil and paper, and two dice. As you make decisions, you will move across the pages of the book (Frames 1–15) which make up the decision tree and game

board), marking your progress with a token. The goal is to complete Frame 15. Deployment, at which point your idea is considered to be physically embodied as equipment in the hands of others.

The R&D Game uses a standard format to track the stages from original concept to final aircraft. The stages ("frames") consist of points ("nodes") connected by route lines. Each route line identifies one possible decision you can make. At each node you may choose among three possible decisions. Each frame requires two successful decisions and then refers you to another frame until you complete the game.

The success of your decisions is moderated by a random factor represented by the Decision Results Table. Dice are used with this table to check for the success of your decision each turn. You record the passage of turns (time) with pencil and paper. The number of turns you take to get through the game and the value of your idea will determine your score. The following rules detail each procedure in the course of the game.

Your Turn

Each turn consists of one single decision choice coupled with the resolution of that decision. Note the passage of the turn on a sheet of paper. Continue to record turns as they pass.

Idea Value

The game assumes that inspiration has struck you at the very beginning of the game, the first node of Frame 1. In addition, the game assumes that your idea is a pristine, perfect idea. You begin the game with an idea value of 10. This value is reduced if play action requires you to go through certain frames of the game. Changes in the value of your idea should also be recorded on your paper.

Decision Results Table. At each turn the player refers to the Decision Results Table (DRT) to resolve the outcome of his choice. This table has columns corresponding to the turn number and lines corresponding to the modified dice roll outcome. To generate this number, roll both dice and modify the roll according to any applicable factors in the frame explanations. Cross-index the modified dice roll with the turn number to discover the result. The table may show the decision to have had no result, it may allow the player to advance along his chosen decision line to the next node on the frame, or it may require him to shift up or down a node on the frame. The result may require the player to return to the origin point of a frame, to go back a frame, or to add to or subtract from the next turn's decision dice roll.

Dice Roll Modifiers. There are a variety of modifiers that act on dice rolls in *The R&D Game*. As you have just read, some of these are set by the outcome of the DRT itself. This kind of effect applies only on the player's turn immediately following the present one. A second type of modifier is that listed by the exit nodes from a frame (for example, "Go to Frame 14," "add 2 to all dice rolls"). These nodal modifiers apply to all dice rolls the player makes in crossing the indicated frame. The last type of modifier results from deliberate choices by the player and is explained in the next section.

Cumulative Modifiers. Modifiers designated by the results table, by the frame in play, and by decision choices (detailed below) act simultaneously and are summed to find the cumulative modifier that is applied to the decision result dice roll. Modified dice results of less than 0 are raised to 0 and modified results greater than 12 equal 12.

Moving Through the Frames. The DRT allows you to move from node to node through the frame along lines determined by the table. After two successful decisions on a frame, your token will arrive at one of the right-hand nodes on a page. Each of these terminal nodes for a frame is printed with an instruction (for example, "Go to 1B"). Immediately turn over the page and consult the "Frame Explanation" with the indicated instruction. The explanation provides a general description of the results of your decisions, informs you of which frame to continue on, and specifies any dice roll modifiers that may apply to you in the play of the following frame.

"Back to Origin Point." Some results on the DRT require the player to "shift" nodes as he advances through the frame. However, a token already occupying one of the top nodes on the frame page, if forced to shift up, would be propelled completely off the decision tree. The same is true for a token occupying a bottom node that is forced to shift down. Tokens that are forced completely off the decision tree must return to the origin point node of the frame in play and repeat the decision process.

The acronym *BOP* for "back to origin point," is printed above each top node and below each bottom node as an instruction for action if a token is forced off the decision tree.

Decision Choices. In moving an idea from conception to deployed hardware, there are limits to a player's choice of decisions. Each possible choice on each node of a frame is identified with a letter *a*, *b*, or *c*; no letter decision choice may be made more than twice in a row. This rule applies from frame to frame as well as for choices made within a single frame.

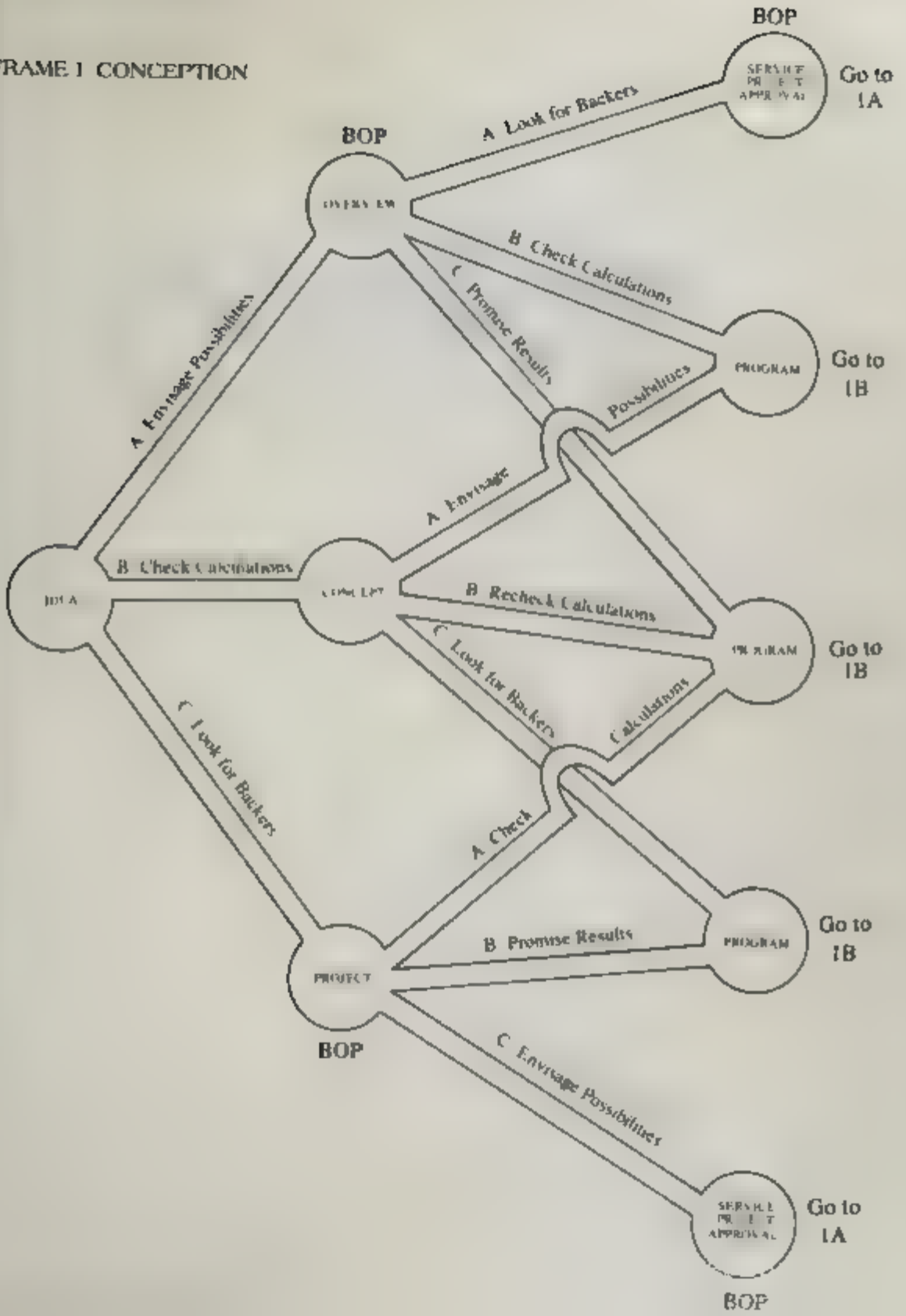
Program Choices. In moving from frame to frame toward deployment, you have the opportunity to make choices affecting the overall direction of your project. In general, you may choose to "politicize" your program or to make it a "high-technology" effort. These changes in status affect your idea throughout the remainder of the game. At certain nodes on some frames a particular letter decision (i.e., decision *a*, *b*, or *c*) is obligatory if you have a program of the type specified. These instructions are printed along with the letter choices in the frames themselves. You must choose the indicated decision regardless of whether you are forced into violation of the decision choice rule. This is the only exception to decision choice allowed.

Multiplayer Game. All rules are designed so that this game can be played solitaire. Nevertheless, any number of persons can actually participate in *The R&D Game*. Each player will need two tokens to represent himself. One indicates the player's own location on a decision tree frame while the second may be used *to block one possible decision for another player* on that person's frame page. At each turn a player may choose either to make a decision and move ahead or to block a decision choice. A player may have only one block in play at any time. The block has a duration of two of the opponent's turns, or until the opponent transits and exits the frame, whichever occurs first. Play continues in the multiplayer game until *any one person* reaches "Deployed" on the last frame. Players then calculate and compare their scores.

Scoring the Game. To calculate your score, simply take the number of turns you took to complete the game and divide it by the number corresponding to your "idea value" remaining at the end of the game. The player with the *lowest* number is the winner.

The R & D Game playing pieces:

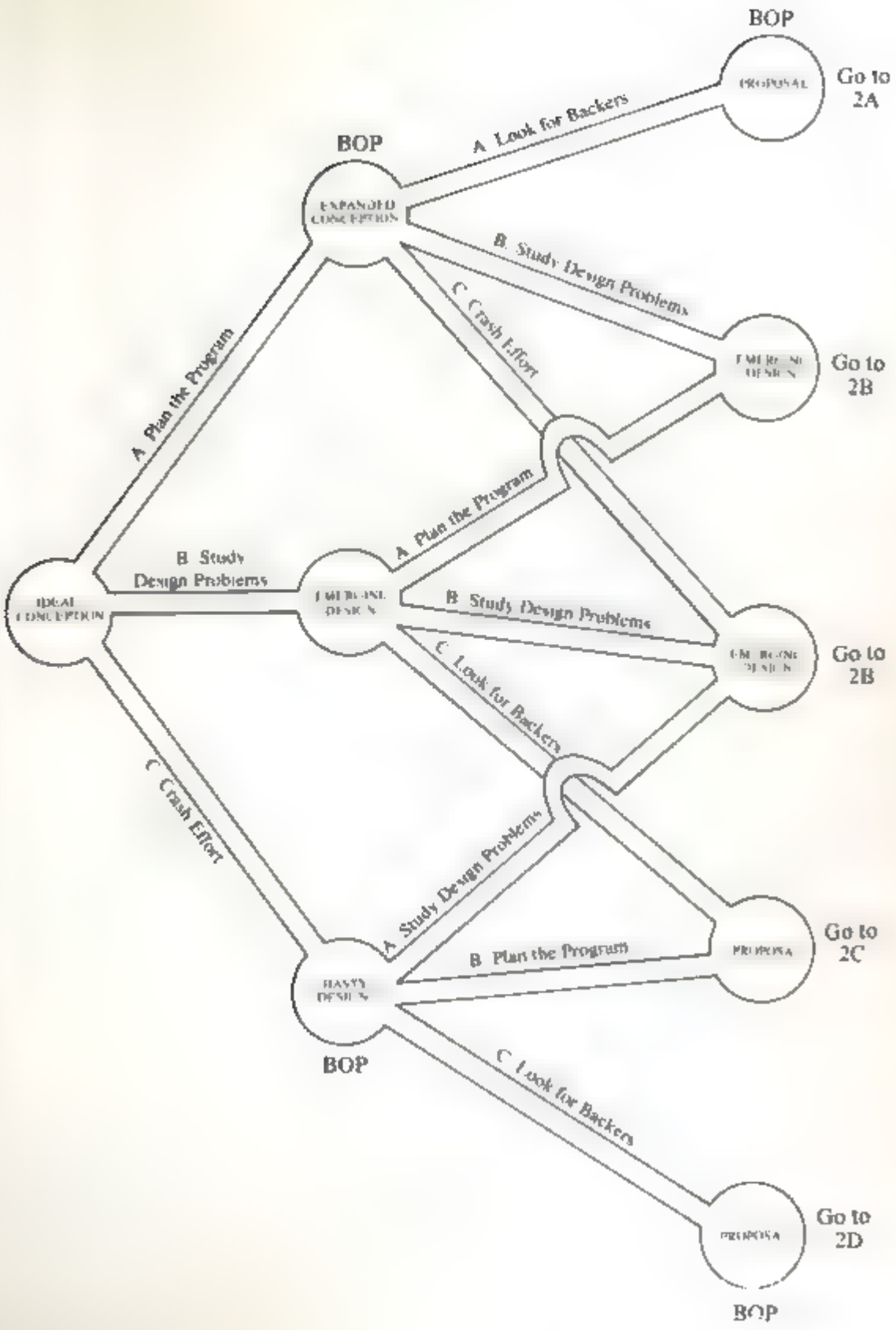
FRAME 1 CONCEPTION



FRAME 1 EXPLANATION

1A By emphasizing the need to press against the edges of technological possibility while looking for backers for a concrete program you have gained enthusiastic supporters and jumped ahead of less visionary projects. Proceed rapidly to Frame 4

1B By checking and rechecking basic concepts and examining the implications of your idea you have succeeded in creating a solid program. Proceed to Frame 2


BOP
PROPOSAL
Go to 2A
A Look for Backers
BOP
EXPANDED CONCEPTION
B Study Design Problems
C Crash Effort
Go to 2B
A Plan the Program
B Study Design Problems
IDEAL CONCEPTION
A Plan the Program
B Study Design Problems
C Look for Backers
Go to 2B
C Crash Effort
A Study Design Problems
B Plan the Program
PROPOSA
Go to 2C
BOP
C Look for Backers
PROPOSA
Go to 2D
BOP

FRAME 2 EXPLANATION

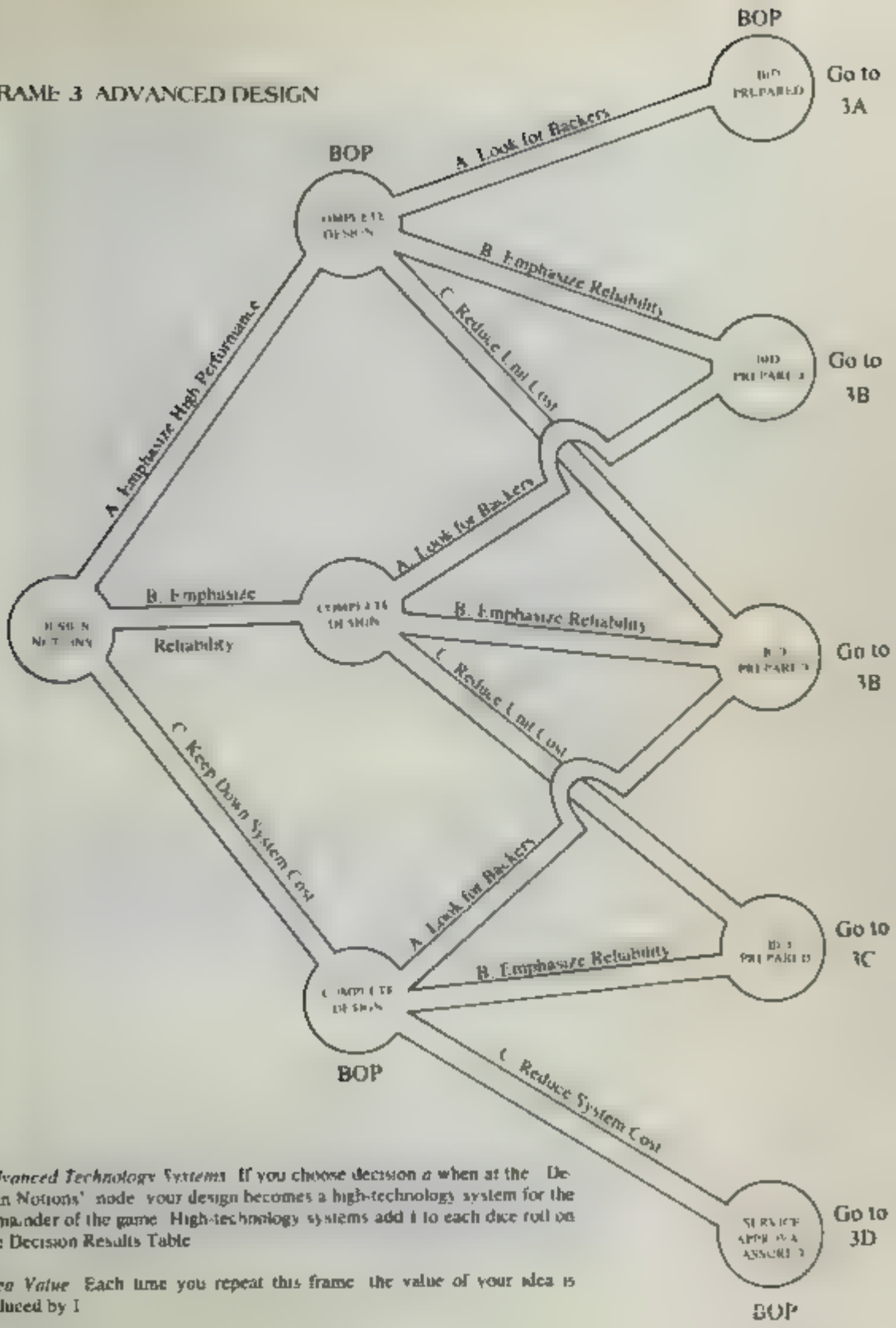
2A You have built up political support for your project. This is of good use in getting money for advanced engineering development. Skip ahead to Frame 4.

2B You have created an engineering design but still need to come up with a program that has a chance to get approved. Proceed to Frame 3.

2C You have planned a program around a crash effort in developing the idea. It is still necessary to put a dollar figure on your bid to get the contract. Proceed to Frame 4. However, on each Decision Results Table dice roll you make on that frame, you will have to add 1 to the result.

2D Although you are planning a crash program, your political backers have carried your project directly to the stage of service approval. Skip ahead to Frame 4. You must also add 1 on every DRT roll in that frame.

FRAME 3 ADVANCED DESIGN



Advanced Technology Systems If you choose decision *a* when at the "Design Notions" node your design becomes a high-technology system for the remainder of the game. High-technology systems add 1 to each dice roll on the Decision Results Table.

Idea Value Each time you repeat this frame the value of your idea is reduced by 1.

FRAME 3 EXPLANATION

3A You have created a high-performance technology but this typically entails complications in development. High-performance systems are also more susceptible to failure, to cost growth, to falling short of performance goals, they are more difficult to correct but offer startling gains if successful. Political backers propel you forward to service approval on Frame 4. On that frame you may subtract 1 from all rolls on the Decision Results Table.

3B Your program proposal continues to be solid. The engineering plans look good, while the emphasis on reliability promises a successful program. Advance to Frame 4.

3C Your program proposal looks very good. Low costs almost assure that the idea can get accepted by a service. Advance to Frame 4. On that frame you may subtract 1 from each roll you make on the DRT.

3D Your project appears so desirable that most decision makers will take it as a natural. As quickly as it circulates around the building, the cost reduction idea is lighting fires in the minds of Pentagon officials. They support your project and propel it immediately toward a full-scale development decision. Go to Frame 5.

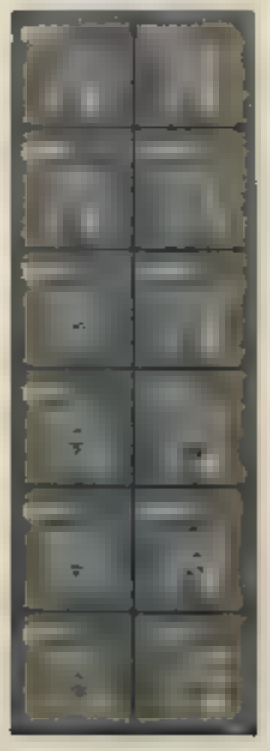
PLAYING PIECES

Last Days at Saigon and Pentagon

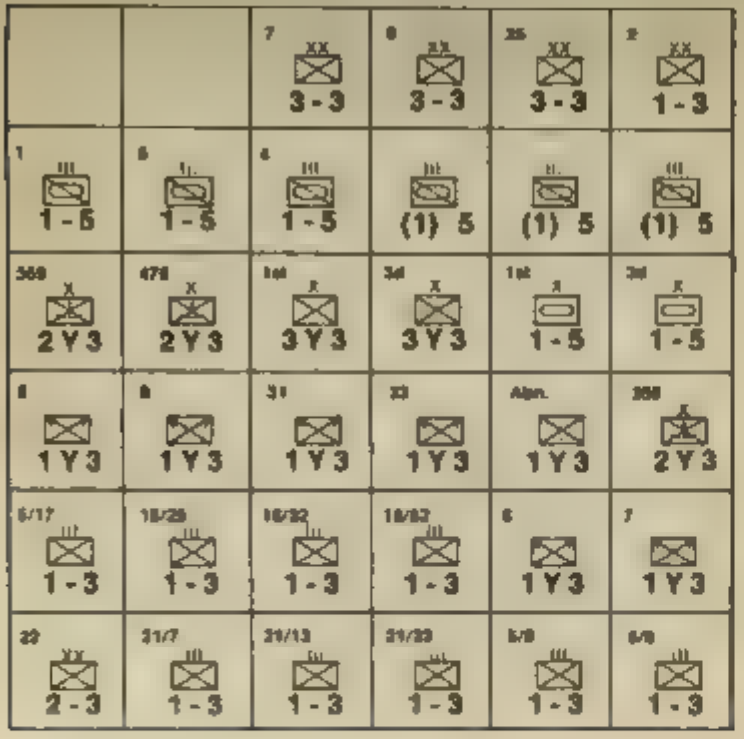
Cut out playing squares along lines

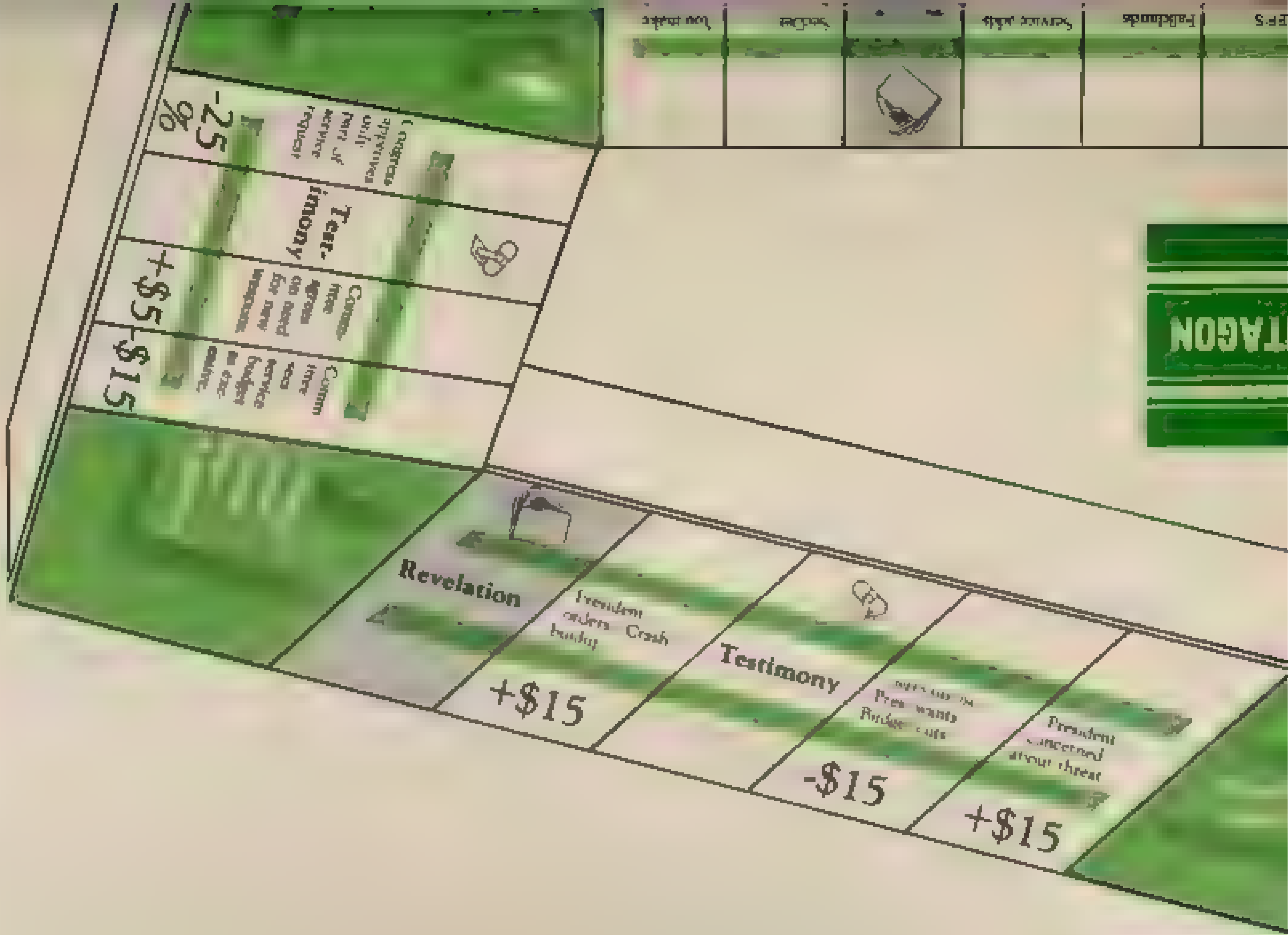
After removing, store playing pieces in zip-loc plastic envelope

COUNTER SHEET FRONT: GVN



COUNTER SHEET BACK: GVN




TAGON
Falklands
Service adds
SecDef
You make
Congress approves only part of service request
-25%
Test-imony
Committee agrees on need for new weapons.
+$5
Committee sees service budget as excessive.
-$15
Revelation
President orders Crash buildup
+$15
Testimony
-$15
President concerned about threat
+$15

Field tests

Heightened

New rule

NATO Alliance

Revelation

Testimony

Revel-ation

+$30

-$15

+$15

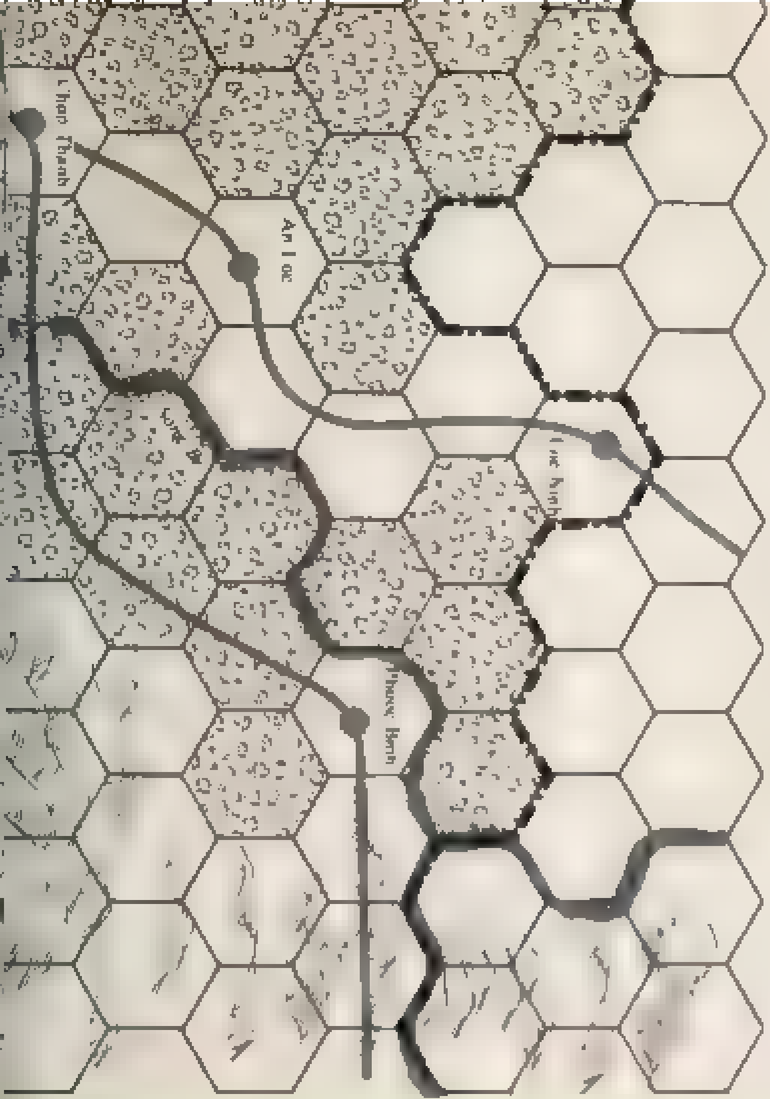
+$5

-$5


Rach Gia
Sa Dec
Cai Be
Vinh Long
My Tho
Tan An
Ben Tre
Phu Vinh
Soc Trang
SAIGON
CHOLON

COMBAT RESULTS TABLE

Die Roll	Difference in Combat S					
	0-7	8-12	13-15	16-17	18-19	20-22
0	●	●	●	●	●	Back2
1	●	●	●	●	Back2	Back2
2	●	●	●	Back2	Back2	Ex
3	●	●	Back2	Back2	Ex	Ex
4	●	Back2	Back2	Ex	Ex	½Ex
5	Back2	Back2	Ex	Ex	½Ex	½Ex
6	Back2	Ex	Ex	½Ex	½Ex	Loss
7	Ex	Ex	½Ex	½Ex	Loss	Loss
8	Ex	½Ex	½Ex	Loss	Loss	Loss



[illegible]-33	33+
Ex	Ex
Ex	½Ex
½Ex	½Ex
½Ex	Loss
Loss	Loss
Loss	Loss
Loss	Loss
Loss	Loss
Loss	Loss

COMBAT RESULTS EXPLANATION

[illegible]

Exchange [illegible]

½ Exchange [illegible]

Loss [illegible]

NOTE [illegible]

CVN TURN RECORD CHART

Date & Turn No.	Reinforcements
31 March **1**	2 × (1)-0 RF/PF
2 April **2**	2 × (1)-0 RF/PF
5 April **3**	1 × 4/3 Marine at Vung Tau 3 × (1)-0 RF/PF
8 April **4**	1 × 3/3 Para at Thu Duc 1 × (1)-0 RF/PF
11 April **5**	1 × 4/3 Marine at Vung Tau 1 × (1)-0 RF/PF 1 × 2/3 Ranger at Saigon

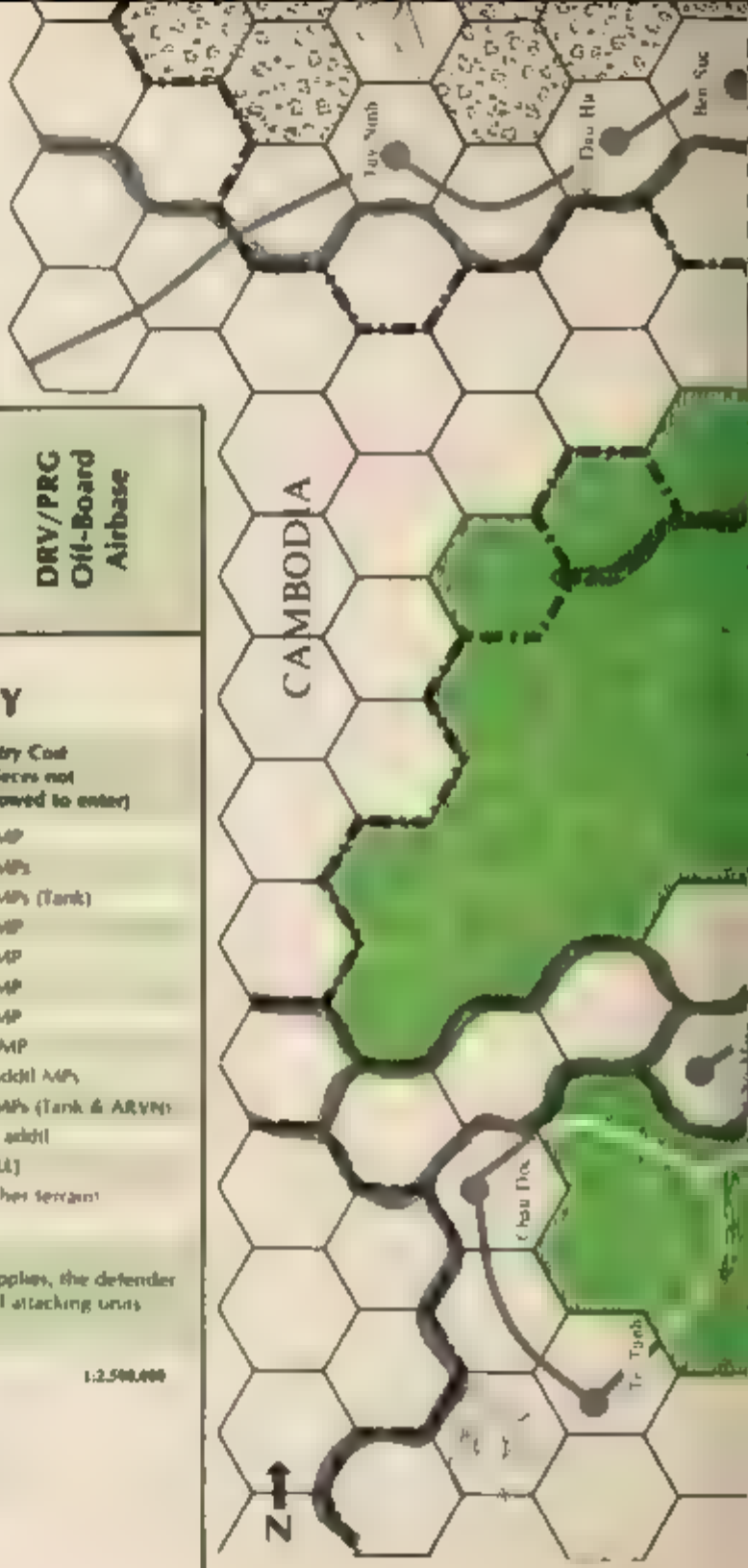
DRV TURN RECORD CHART

Date & Turn No.	Reinforcements
31 March **1**	1 × 8-4 Infantry 2 × 2-4 NLF at "A"
2 April **2**	2 × 8-4 Infantry at Bao Loc
5 April **3**	1 × 8-4 Infantry at Bao Loc
8 April **4**	1 × 8-4 Infantry 2 × NLF at Loc Ninh
11 April **5**	1 × 8-4 Infantry at Phuoc Binh 1 × aircraft off board
14 April **6**	2 × 8-4 Infantry, 1 × 3-6 Armor at "A" 1 × aircraft off-board
17 April **7**	1 × 8-4 Infantry 1 × 3-6 Armor, at "A"
20 April **8**	2 × 2-4 NLF at Loc Ninh
23 April **9**	
26 April **10**	
29 April **11**	
2 May **12**	

	6
2 = 1;-0 Rf/Pf*	17 April
	7
2 = 1)-0 Rf/Pf*	20 April
	8
	23 April
	9
	26 April
	10
	29 April
	11
	2 May
	12

* Rf/Pf units arrive at any town or City or Admin. Center and may not move

DRV/PRG Off-Board Airbase



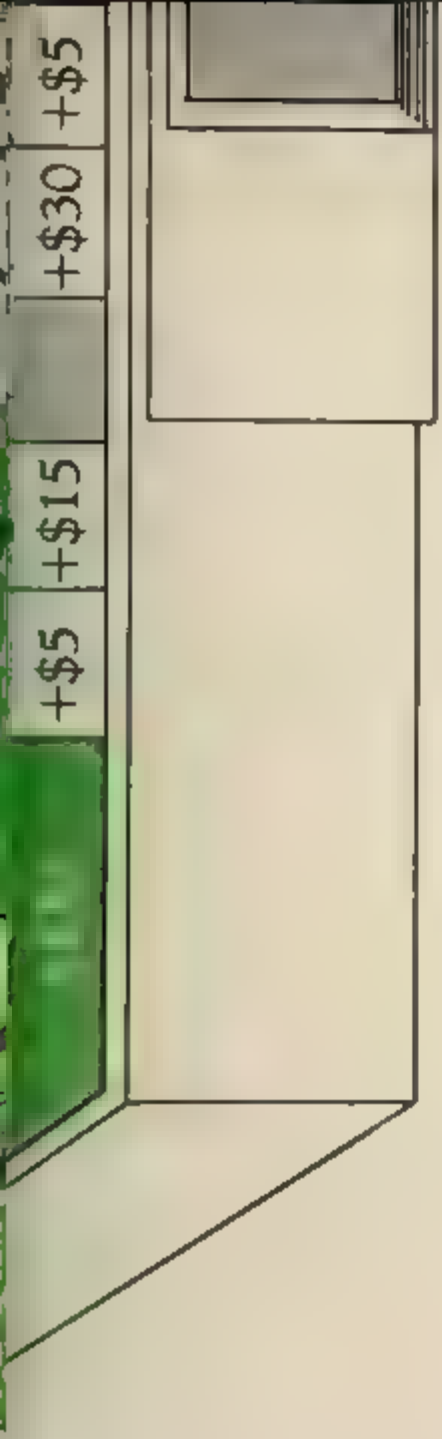
TERRAIN KEY

Terrain Type	Effect on Defender's Combat Value	Entry Cost (pieces not allowed to enter)
Town	doubled	1 MP
Jungle	doubled	2 MPs
Mountain	doubled	2 MPs (Tank)
City	tripled	1 MP
Airbase	tripled	1 MP
Admin. Cent.	tripled	1 MP
Clear	none	1 MP
Road hexside	(other terrain)	½ MP
River hexside	doubled*	2 addtl MPs
Swamp	none	2 MPs (Tank & ARVN)
Border	none	no addtl
Sea	n/a	(ALL)
Port (sea transfer)	(other terrain)	(other terrain)

Note: Where more than one terrain type applies, the defender chooses which effect to apply. * = only if all attacking units attack across the river

1:2,500,000

LAST DAYS AT SAIGON



30	Additional spare parts found necessary for many service weapons systems, add $10
31	President decides on military intervention in a Caribbean nation, lose next turn planning invasion
32	Congress receives independent study showing service "threat assessments" to be exaggerated, cuts $10
33	President determines to submit next year's budget request early, advance to next "Approval" square
34	Technological breakthrough to be exploited by new weapon system, add $10
35	Service Chief is required to attend annual "political-military" crisis simulation, lose next turn
40	Falling price of oil reduces operating costs, lose $5
41	Cost overruns in newest high performance system results in "stretching out" procurement, reduce request $10.
42	General Accounting Office report discovers irregularities in administration of military bases, advance to the next "Testimony" square
43	NATO maneuvers demonstrate need for more conventional forces, add $10
44	Blue Ribbon Panel recommends changes in military planning, lose next turn reviewing the proposals
45	Congress acts to reduce budget deficit by holding down defense spending, cut $15.
50	Foreign aid punch leads President to divert some military funds, lose $5
51	Service chiefs argue over military program, return to the last Joint Chiefs of Staff square and reargue issues
52	Disarmament agreement with main adversary reduces the military threat, cut $15
53	Congress revises priorities in favor of social programs, cuts back defense spending $15
54	Public opposes excessive defense spending, Congress cuts your request $10
55	Service Chiefs hustle to reach agreed position on arms control, lose next turn in meetings

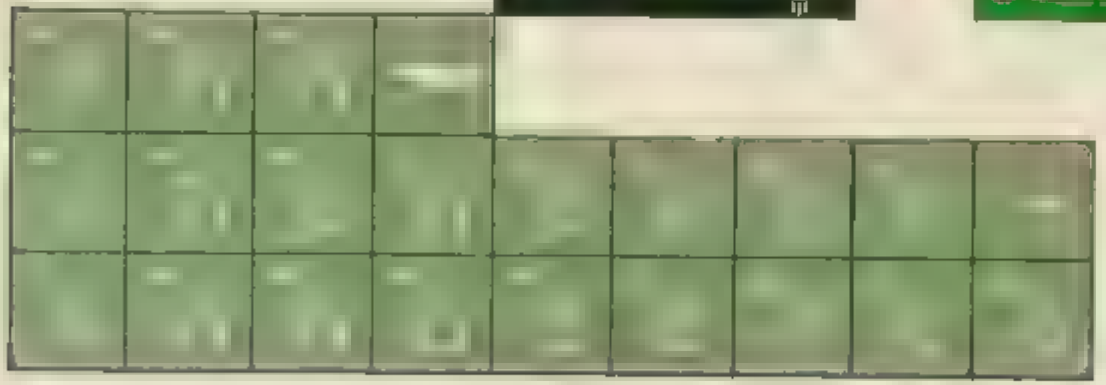
REVELATION DETAILS

"Base 6" Number Rolled	Meaning
00	Field Exercises show poor readiness among combat units increase operations and maintenance request $5
01	Systems Analysis studies show a critical lack of the latest type weapons, add $10 to request
02	Consultants recommend procurement of additional precision-guided munitions, add $10.
03	Recent Middle East fighting reveals important faults in present weapons, fix them for $10
04	Budget surplus and healthy economy allow greater allocations for defense, add $5
05	Crash of latest type aircraft starts a "flap," lose next turn finding out the details
10	Congressional inability to pass last year's budget brings resort to a continuing resolution, lose next turn
11	Congress cracks down after press reveals secret diversion of military funds to a prohibited covert action program, lose $10
12	Opponents slip derogatory information on service performance to Secretary of Defense, lose next turn briefing him.
13	Repeated failure of latest weapon in tests prompts a Presidential budget review, lose $10.
14	Congress conducts investigation of questionable procurement practices, lose one turn testifying on Capitol Hill
15	Another service has the ear of Congress, lose $5
20	Long-planned field exercises result in complete command muddle, lose next turn explaining to Service Secretary
21	Congress cuts funds after investigative report reveals collusion between military and industry in granting new contracts, lose $10.
22	Secretary of Defense shifts money from Pentagon-initiated wargame studies into funding combat forces, add $5
23	Top Secret commando raid fails spectacularly, lose the next two turns in total disarray
24	Careful testing shows new weapon to be totally useless, Secretary of Defense deletes program for $10
25	New urgency in defense budget planning, advance [illegible] to next [illegible] Chiefs of Staff meeting causes

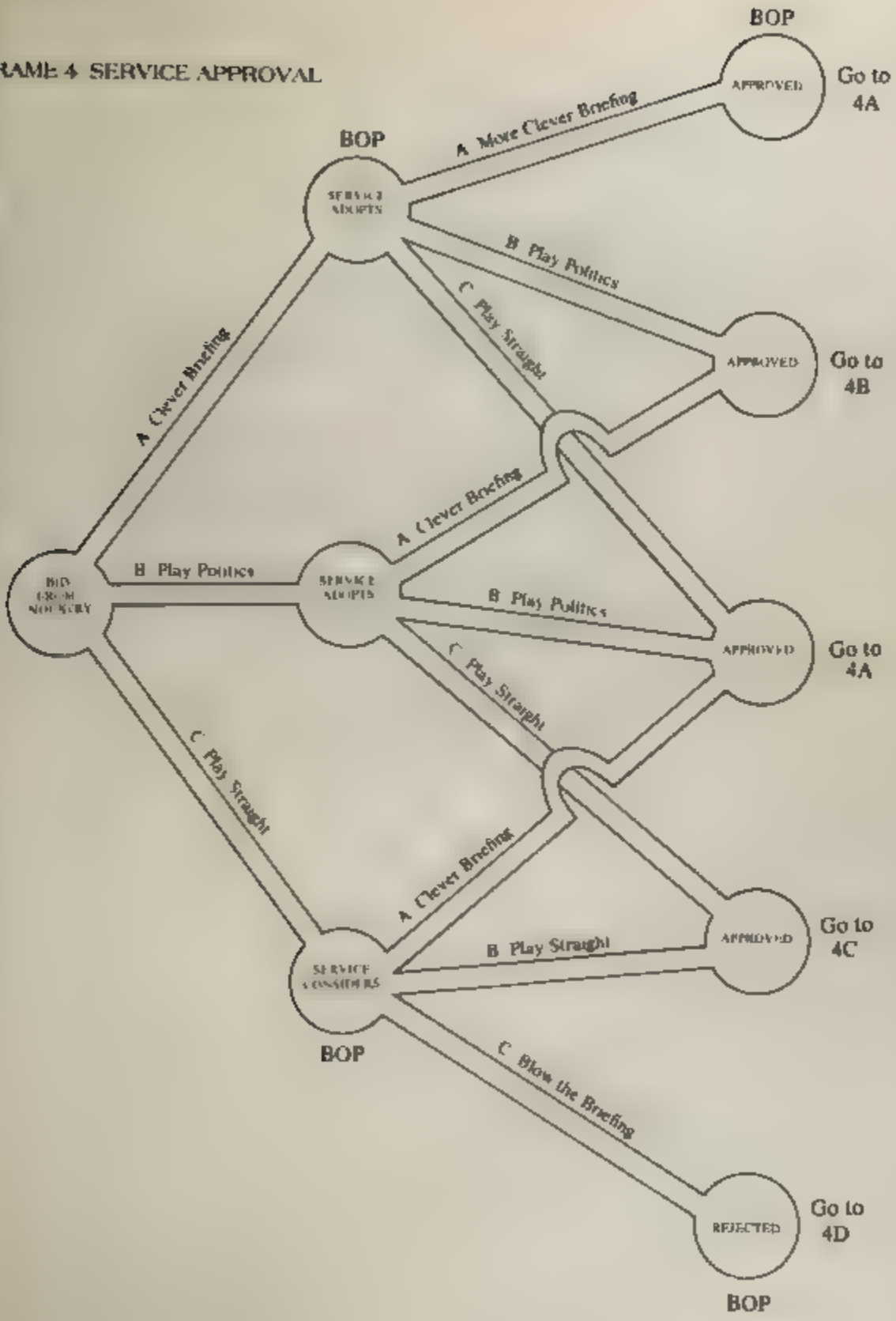
COUNTER SHEET BACK DRV

COUNTER SHEET FRONT DRV

US	US	ARVN	JGS
Depen-dent	Depen-dent	Depen-dent	Depen-dent
	GVN	VNN	VNAF
	Depen-dent	Depen-dent	Depen-dent



FRAME 4 SERVICE APPROVAL



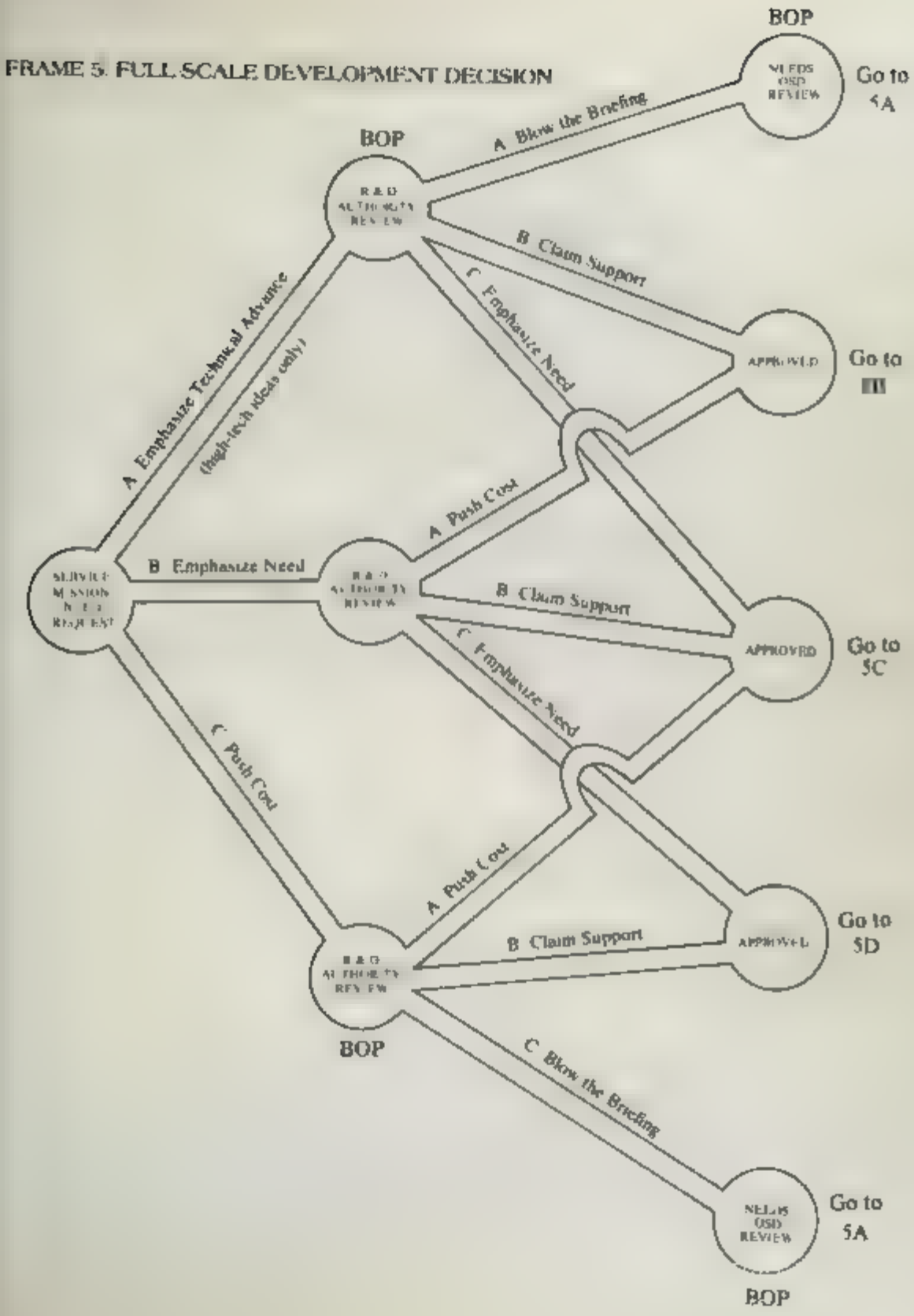
FRAME 4 EXPLANATION

4A It was a grandstand performance! You may proceed to try for a decision on full-scale development. Go to Frame 5. However, opponents of the plan are now frustrated and will redouble their efforts to defeat your project. On your next frame you must add 2 every time you roll on the DRT.

4B The briefing went well. By playing politics after that you lined up enough backers at the Pentagon to move the project up to the level of the secretary of defense for a decision on full scale development. Proceed to Frame 5. Unfortunately, one service does not a Pentagon make! The other armed services are very sensitive about their roles and missions. On your next frame you must add 1 to every DRT dice roll.

4C Service officials have carefully considered your proposal. They are unpressed. So are the military officers on the Pentagon staffs. You may advance to Frame 5 for a full-scale development decision. On that frame you may subtract 1 from each DRT dice roll.

4D The idea was good, but that briefing destroyed it. If only that colonel at the end of the table hadn't had that chart demonstrating that the projects already approved exceeded budget levels. It's time to plan a new program, go back to the drawing board and to Frame 2.


FRAME 5. FULL SCALE DEVELOPMENT DECISION
BOP
NEEDS OSD REVIEW
Go to 5A
A Blow the Briefing
BOP
R & D AUTHORITY REVIEW
B Claim Support
C Emphasize Need
APPROVED
Go to III
A Emphasize Technical Advance
(high-tech ideas only)
A Push Cost
B Emphasize Need
SERVICE MISSION NEED REQUEST
R & D AUTHORITY REVIEW
B Claim Support
C Emphasize Need
APPROVED
Go to 5C
C Push Cost
A Push Cost
B Claim Support
R & D AUTHORITY REVIEW
APPROVED
Go to 5D
BOP
C Blow the Briefing
NEEDS OSD REVIEW
Go to 5A
BOP

FRAME 5 EXPLANATION

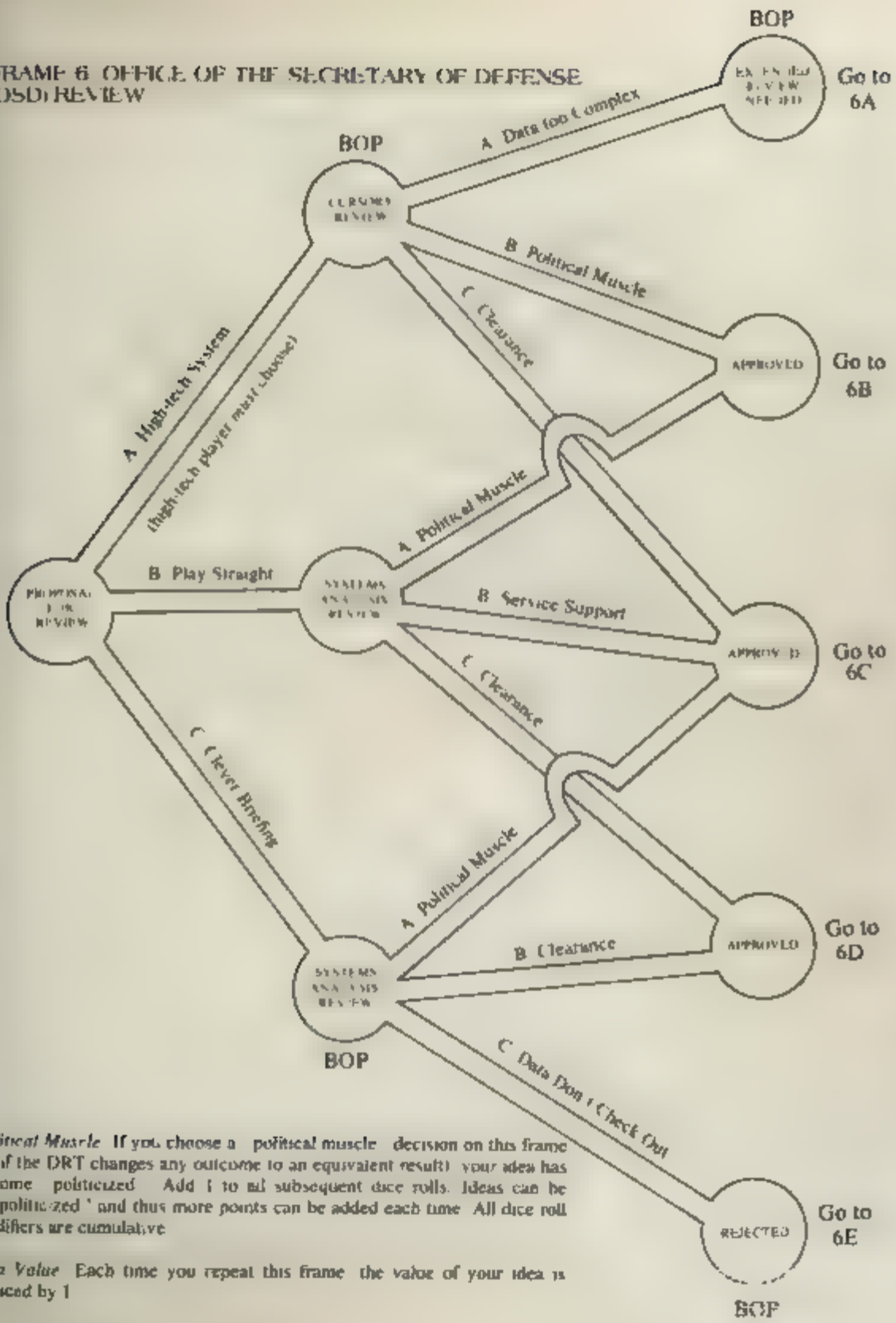
5A Even though you marshaled as much support as you could get for the project your last briefing didn't get the point across. The project now faces a tough hurdle—a program review from the office of the secretary of defense! Proceed to Frame 6.

5B You hit the right arguments to trigger support for the project. But the program is also in a weak position after cutting corners to hold down costs while stepping on bureaucratic toes in the rush for approval. Advance to Frame 7. On that frame you must add 2 each time you use the DRT.

5C Your project seems solid and has been approved. A few Pentagon officials could waver if anything happens to disturb the comfortingly low cost trends the project has shown so far. Move ahead to Frame 7. On that frame you must add 1 to each DRT dice roll.

5D Your project gathers wide approval. Officers and officials all over the building speak confidently of getting hardware from your program in their hands. Skip ahead to Frame 7.

FRAME 6 OFFICE OF THE SECRETARY OF DEFENSE (OSD) REVIEW



Political Muscle If you choose a political muscle decision on this frame (or if the DRT changes any outcome to an equivalent result) your idea has become politicized. Add 1 to all subsequent dice rolls. Ideas can be 'repoliticized' and thus more points can be added each time. All dice roll modifiers are cumulative.

Idea Value Each time you repeat this frame the value of your idea is reduced by 1.

FRAME 6 EXPLANATION

6A OSD thinks the data on this high-technology project you have proposed are too complex to be understood easily. The secretary of defense sends your proposal back for a full-scale development decision. Return to Frame 5.

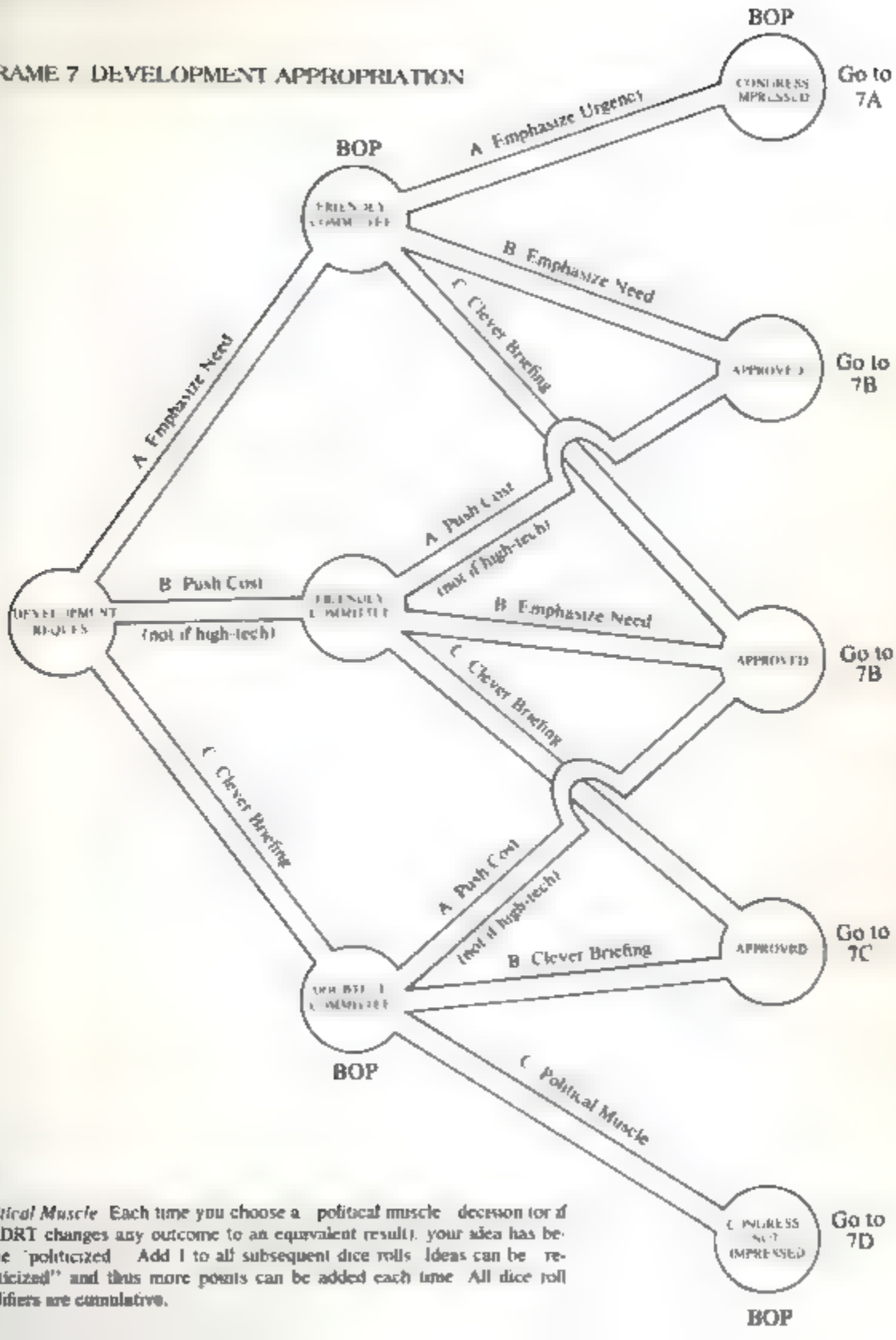
6B Using political muscle can get approvals, but it usually makes a project proposal more vulnerable in the long run to the opposition's political muscle. Proceed to Frame 7. On that frame you must add 2 to each dice roll you make on the DRT.

6C Your project just barely received OSD approval. Advance to Frame 7. On that frame you must add 1 to each roll on the DRT.

6D Your project sailed through OSD review with flying colors. Officials around the building are pricking up their ears when they hear of your exploits. Advance to Frame 7.

6E. The systems analysts did their homework much better than you thought they would. It was all downhill after they caught you on those claims about the flexibility and cost advantages of your system over those already in production. Trudge back to Frame 2.

FRAME 7 DEVELOPMENT APPROPRIATION



Political Muscle Each time you choose a "political muscle" decision (or if the DRT changes any outcome to an equivalent result), your idea has become "politicized." Add 1 to all subsequent dice rolls. Ideas can be "re-politicized" and thus more points can be added each time. All dice roll modifiers are cumulative.

FRAME 7 EXPLANATION

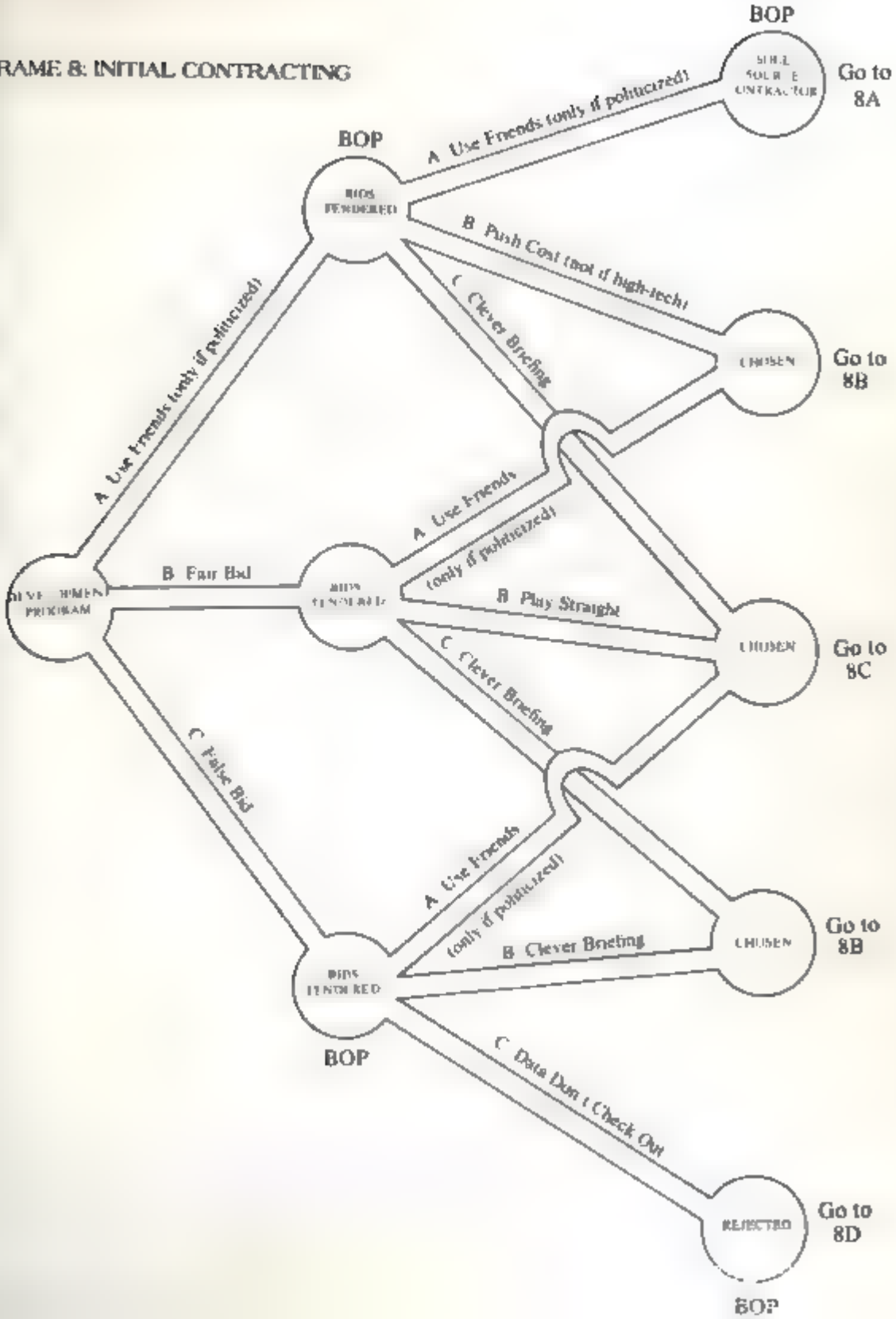
7A Your hardware is needed sorely and soon. Congress would have appropriated twice as much if it had been requested! Skip ahead to Frame 9.

7B Senators and representatives are often happy to support low-cost defense programs that promise sensible gains in capability. Advance to Frame 8.

7C Your last committee hearing was a little difficult. Had Congressman Smith pressed you a little harder on your estimates of when finished hardware could be in the field, the whole request could have come unraveled. Proceed to Frame 8. On that frame you will have to add 1 to each of your DRT dice rolls.

7D A complete disaster! How *could* you have known that the senator was already enraged by the political maneuvering that has surrounded your program request? There will be no way to pursue the project further in its present form. Return wearily to Frame 4.

FRAME 8: INITIAL CONTRACTING



FRAME 8 EXPLANATION

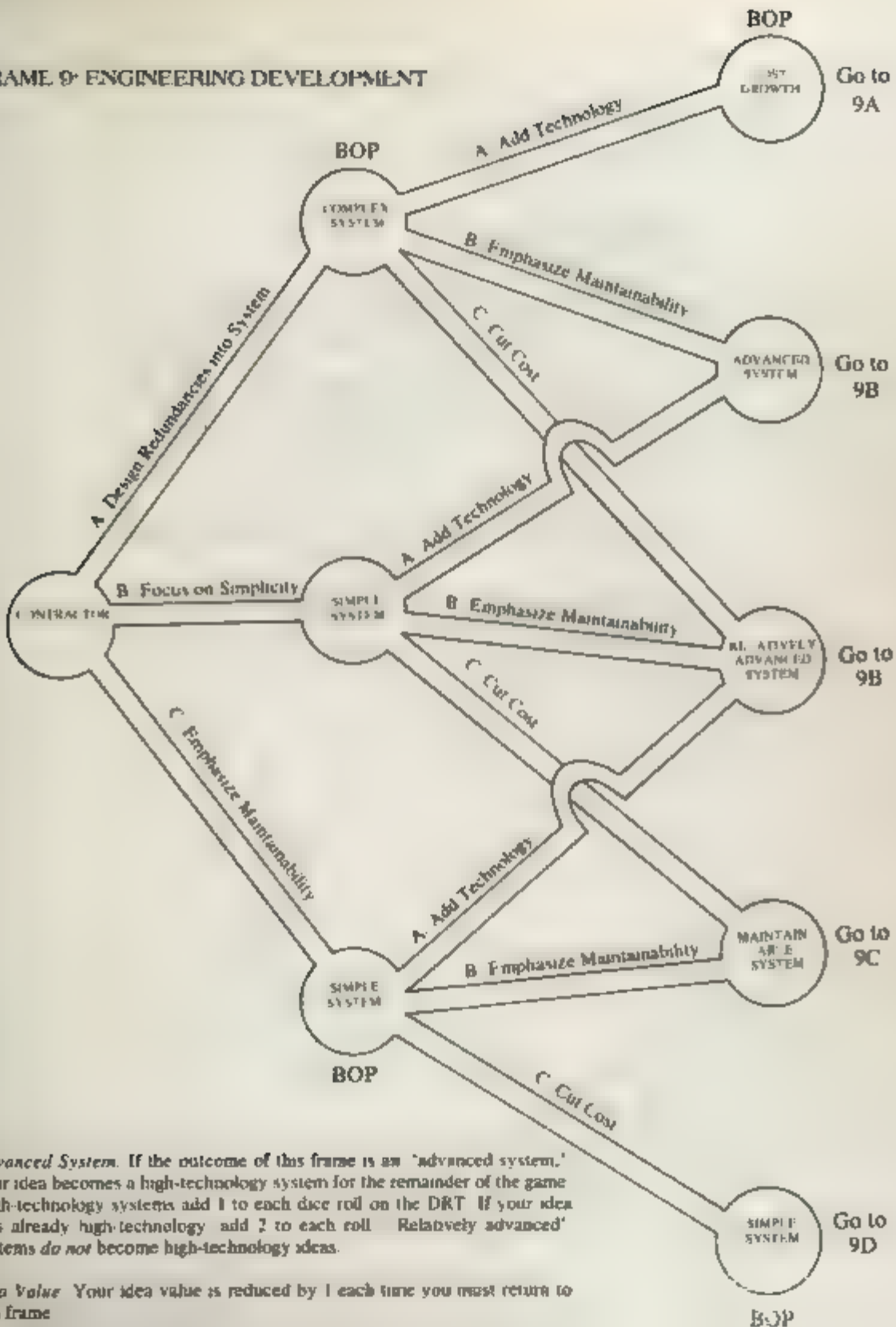
8A You have succeeded in getting a contract that makes your company the sole source for the hardware you have proposed. This is good from the standpoint of company revenue, but it also means that in case of failure there is nobody to blame but you. Advance to Frame 9. On that frame you must add 2 to each of your dice rolls using the DRT.

8B Friends in high places have pulled the project through, and your company has been granted the contract. Now your friends will be looking for good results. Advance to Frame 9. On that frame you must add 1 to each DRT dice roll.

8C Either your fuz bid sailed through or well-placed supporters were able to overcome the opposition. You have been awarded a contract to produce hardware. Move ahead to Frame 9.

8D It was a big mistake to have made a bid that understated the potential cost of your proposal. The research and development people had dealt with other similar hardware projects before and immediately saw through the dummied-up cost figures. Move back to Frame 2.

FRAME 9: ENGINEERING DEVELOPMENT



Advanced System. If the outcome of this frame is an "advanced system," your idea becomes a high-technology system for the remainder of the game. High-technology systems add 1 to each dice roll on the DRT. If your idea was already high-technology, add 2 to each roll. Relatively advanced" systems *do not* become high-technology ideas.

Idea Value. Your idea value is reduced by 1 each time you must return to this frame.

FRAME 9 EXPLANATION

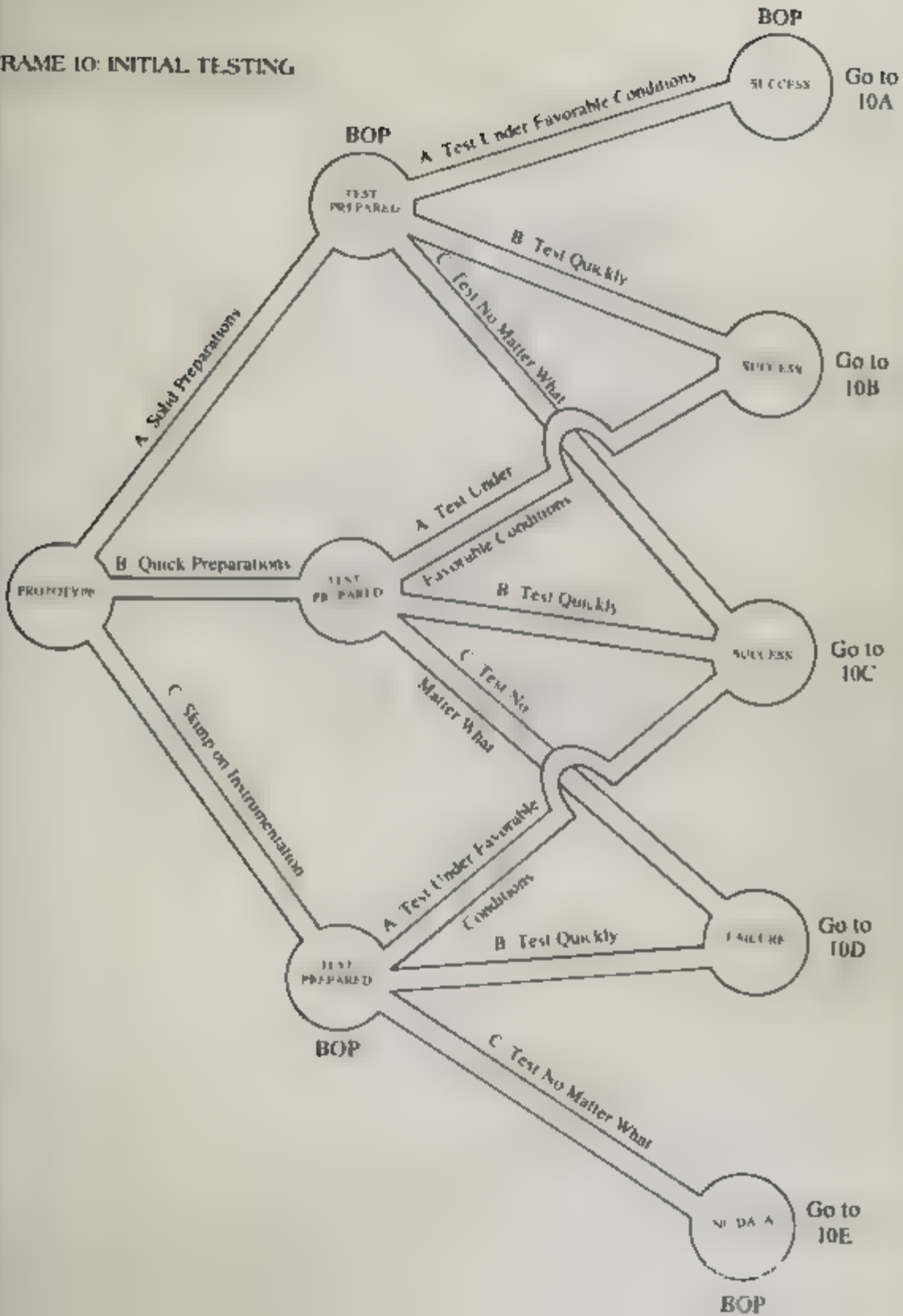
9A The hardware you are developing has been increasing in cost even as you add technological improvements to it. The office of the secretary of defense has decided to review your program. Return to Frame 6.

9B You have produced hardware that is technologically advanced. Still, most observers of Pentagon research and development agree that the single most critical element from the standpoint of securing a final production contract is to get the system through the stage of engineering development. Advance to Frame 10.

9C You are successful in engineering a system that promises reasonable cost and good service. Advance to Frame 10. On that frame you may subtract 1 from each dice roll using the DRT.

9D Your success at engineering hardware of great simplicity promises to result in one of the lowest-cost pieces of hardware produced in recent years. Officials in The Building are very excited about the possibilities. Advance to Frame 10. On that frame you may subtract 2 from each DRT dice roll.

FRAME 10: INITIAL TESTING



FRAME 10 EXPLANATION

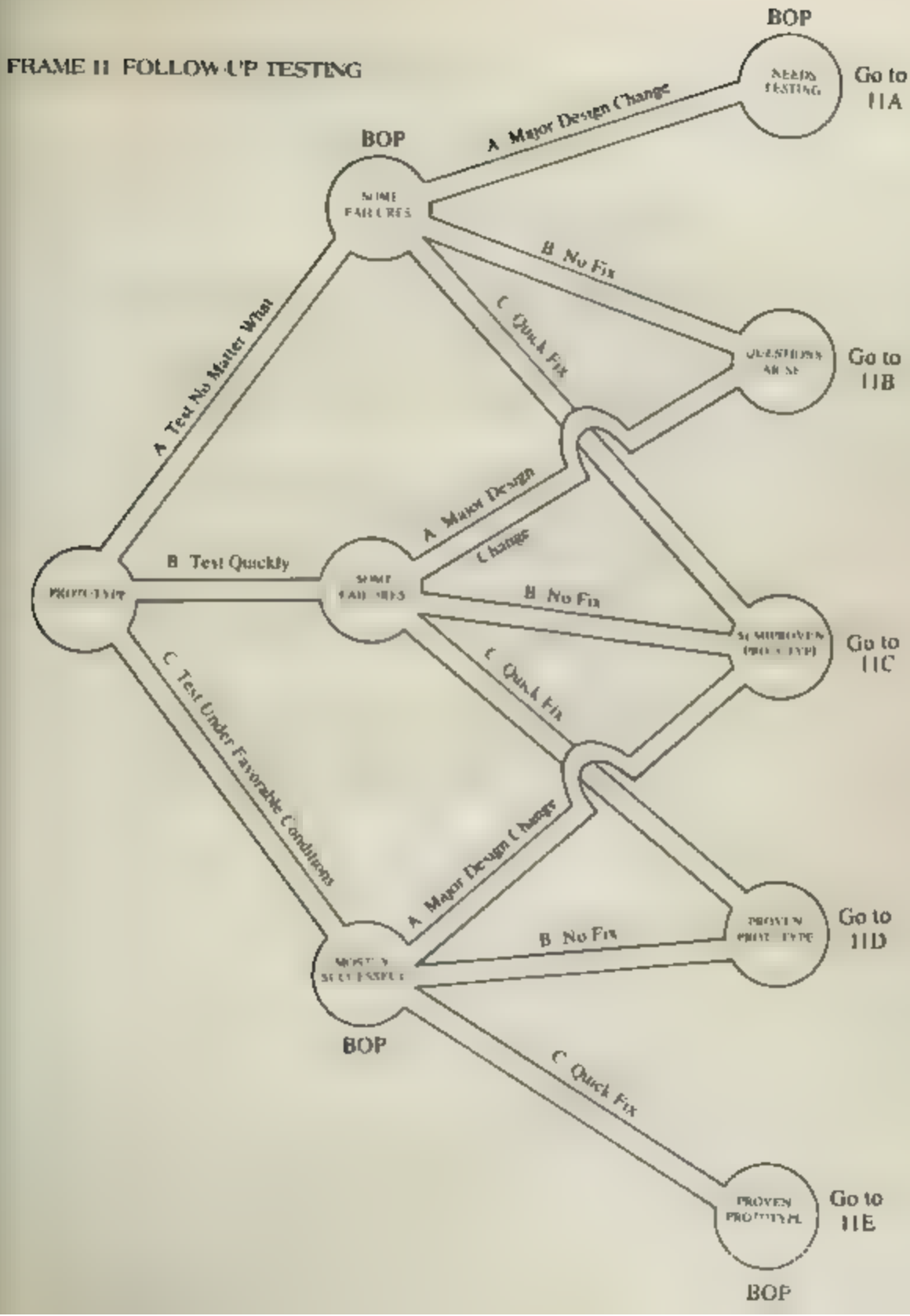
10A The testing program you have conducted demonstrates well-designed, well-built hardware. Advance to Frame 11. On that frame you may subtract 1 from each dice roll you make using the DRT.

10B Your initial testing was good. Research and development officials agree that the system hardware should progress to follow-up testing. Advance to Frame 11.

10C Your initial testing went fairly well. The Pentagon has approved follow-up testing for the hardware, but in a few quarters doubts are growing about the hardware you have designed. Move ahead to Frame 11. On that frame you must add 1 to each dice roll on the DRT.

10D Disregard of test conditions has led to critical failures in the initial testing of your hardware. The prototype is ruined and must be reconstructed. The office of the secretary of defense has pulled your project in for a review by systems analysis experts. Return to Frame 6.

10E Faulty instrumentation and poor test conditions mean that you don't even have the data from the initial tests to answer urgent questions about the failure of the prototype. News of the problems with your program has gotten beyond the building, and you must prepare for an investigation initiated by Congress. Go directly to Frame 12.


FRAME 11 FOLLOW-UP TESTING
BOP
NEEDS TESTING
Go to IIA
A Major Design Change
BOP
SOME FAILURES
B No Fix
C Quick Fix
QUESTIONS ARISE
Go to IIB
A Test No Matter What
A Major Design Change
B Test Quickly
PROTOTYPE
SOME FAILURES
B No Fix
IMPROVEN (PROTOTYPE)
Go to IIC
C Quick Fix
C Test Under Favorable Conditions
A Major Design Change
B No Fix
PROVEN PROTOTYPE
Go to IID
BOP
C Quick Fix
PROVEN PROTOTYPE
Go to IIE
BOP

FRAME 11 EXPLANATION

11A To cope with 'bugs' in the hardware operation you have been forced to redesign parts of the systems. Now you must make initial tests of the newly engineered modifications. Return to Frame 10.

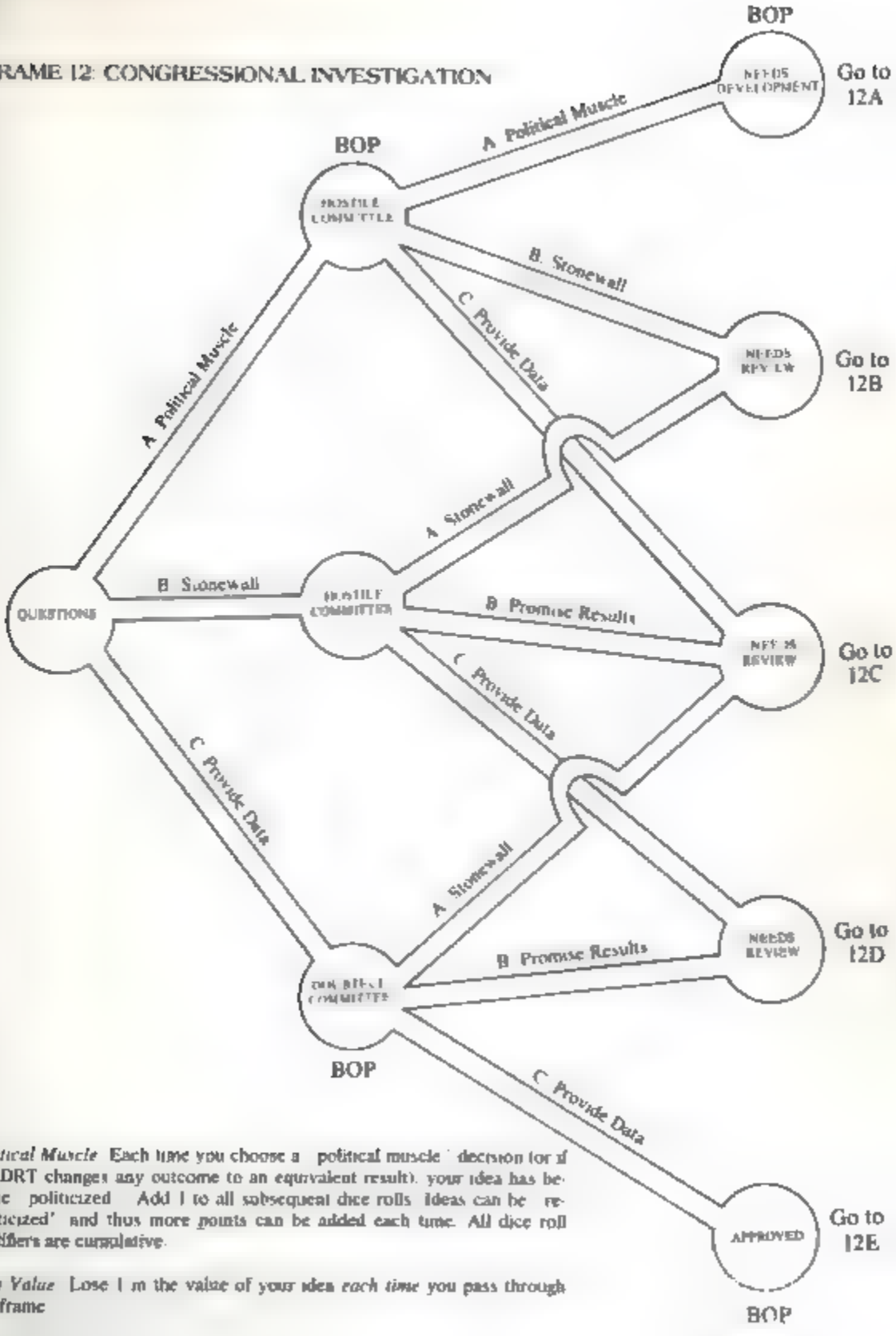
11B Questions have been raised about repeated failures in the follow-up testing of your prototype. A Senate defense subcommittee is holding hearings and has called on you to testify. Proceed immediately to Frame 12.

11C Although there were some failures in your test program so many Pentagon officials regard getting your hardware into the field as vital that your project is being pushed ahead to production engineering. Advance to Frame 13. On that frame, however, you must add 1 to each roll on the DRT.

11D Despite a few failures in your test program the prototype is regarded as having proved itself in operation. Officials have approved the hardware for manufacture. Production engineering is necessary. Advance to Frame 13.

11E Your test program was mostly successful. You were even able to fix quickly the few bugs that cropped up in operating the hardware. Officials in the building are confident that production engineering can be finished fast and manufacturing can start soon. Proceed to Frame 13. On that frame you may subtract 1 from each DRT dice roll.

FRAME 12: CONGRESSIONAL INVESTIGATION



Political Muscle Each time you choose a 'political muscle' decision (or if the DRT changes any outcome to an equivalent result), your idea has become 'politicized.' Add 1 to all subsequent dice rolls. Ideas can be 're-politicized' and thus more points can be added each time. All dice roll modifiers are cumulative.

Idea Value Lose 1 in the value of your idea *each time* you pass through this frame.

FRAME 12 EXPLANATION

12A Political support has prevented the complete termination of your project. However, the congressional investigation has determined that your hardware has problems and requires additional engineering development. Return to Frame 9.

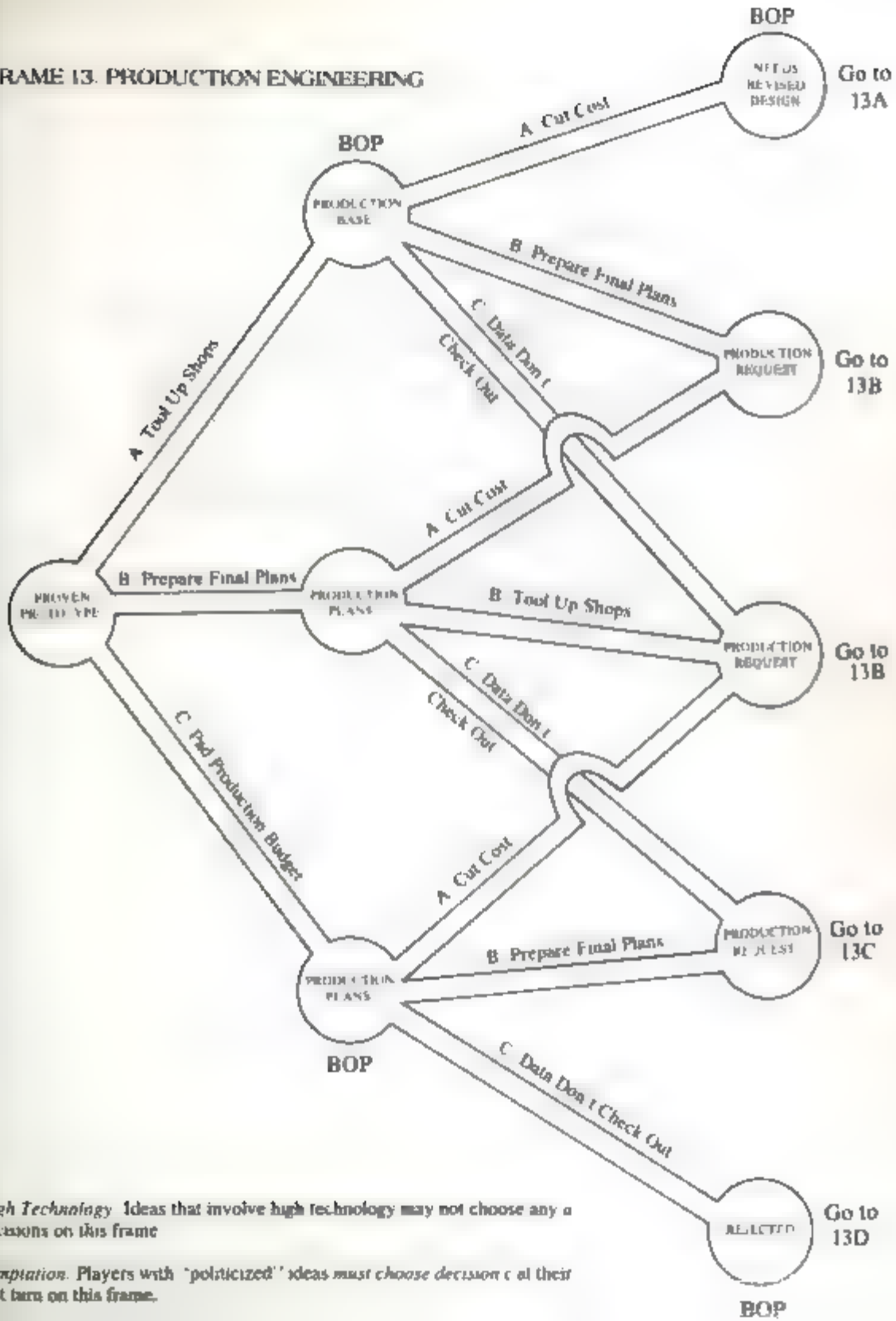
12B The members of Congress became especially upset once they perceived your effort to provide minimal information to the investigators. Your political support was insufficient to prevent an agreement between the congressional committee and the secretary of defense under which your project will be scrutinized by an OSD review. Return to Frame 6. On that frame you must add 1 to each dice roll you make using the DRT.

12C A hostile congressional investigation has uncovered the worst problems of your project. Now the secretary of defense has decided on an OSD review of your proposals. Return to Frame 6.

12D Although difficulties with your project have been uncovered, cooperation with the investigators has gained you some political support. Return to Frame 6. On that frame your new support enables you to subtract 1 from each DRT dice roll.

12F Your cooperation with the investigation has turned heads and changed minds. The doubtful committee has been converted to believers in your project. Advance to Frame 13.

FRAME 13. PRODUCTION ENGINEERING



High Technology. Ideas that involve high technology may not choose any o decisions on this frame

Temptation. Players with "politicized" ideas *must choose decision* c al their first turn on this frame.

FRAME 13 EXPLANATION

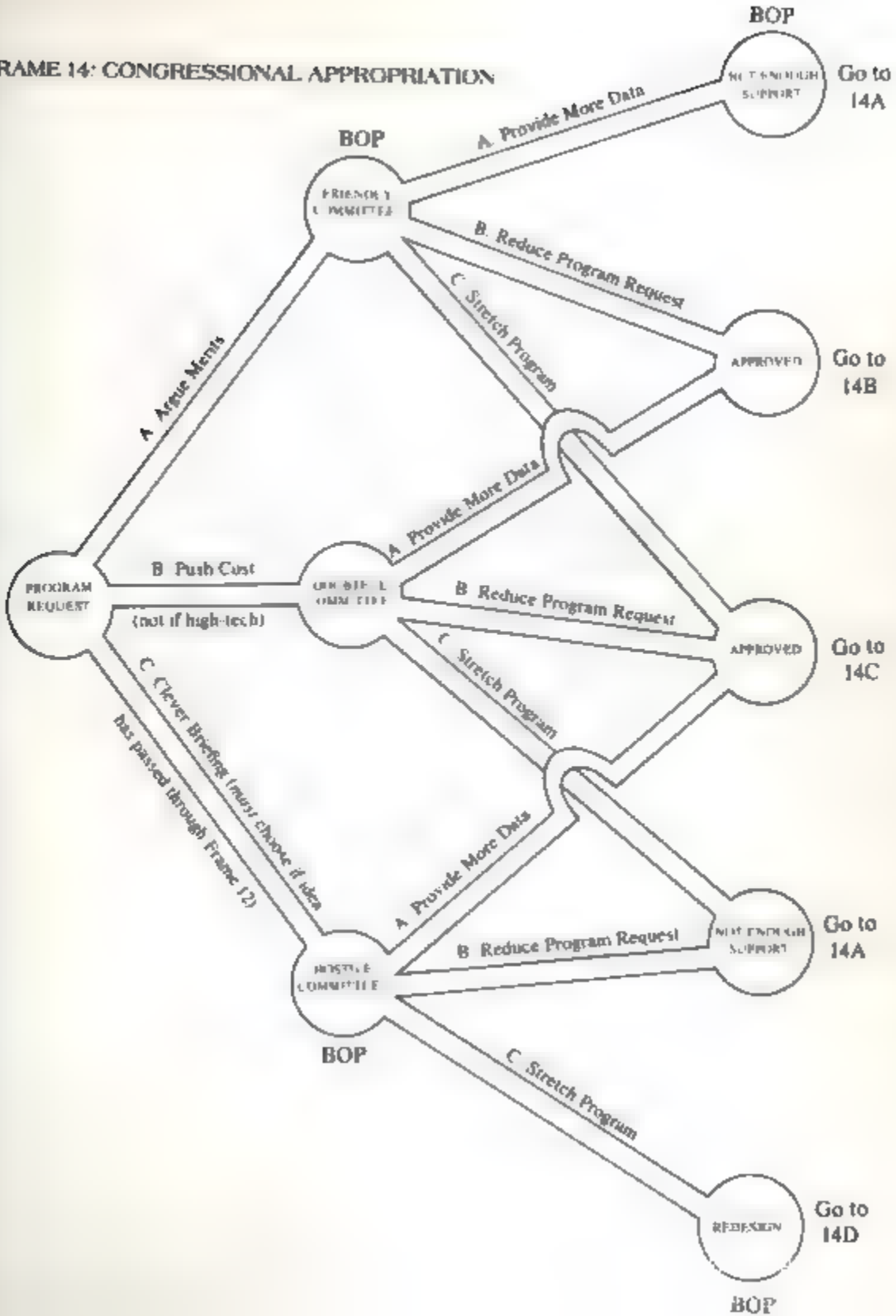
13A Major design changes at the last moment always require the retooling and reworking of certain engineering features of the hardware. You must resume engineering development. Return to Frame 9.

13B Your production request has been completed. You may proceed to seek money from Congress for the production of your hardware. Advance to Frame 14.

13C Your production request is assembled, although some problems are still unresolved. Congress is ready to debate funding the production of your hardware. Advance to Frame 14. On that frame you must add 1 to each dice roll you make using the DRT.

13D. Your padded production request has been uncovered—with disastrous effects. Your project has been terminated. Trudge back to Frame 2.

FRAME 14: CONGRESSIONAL APPROPRIATION



FRAME 14 EXPLANATION

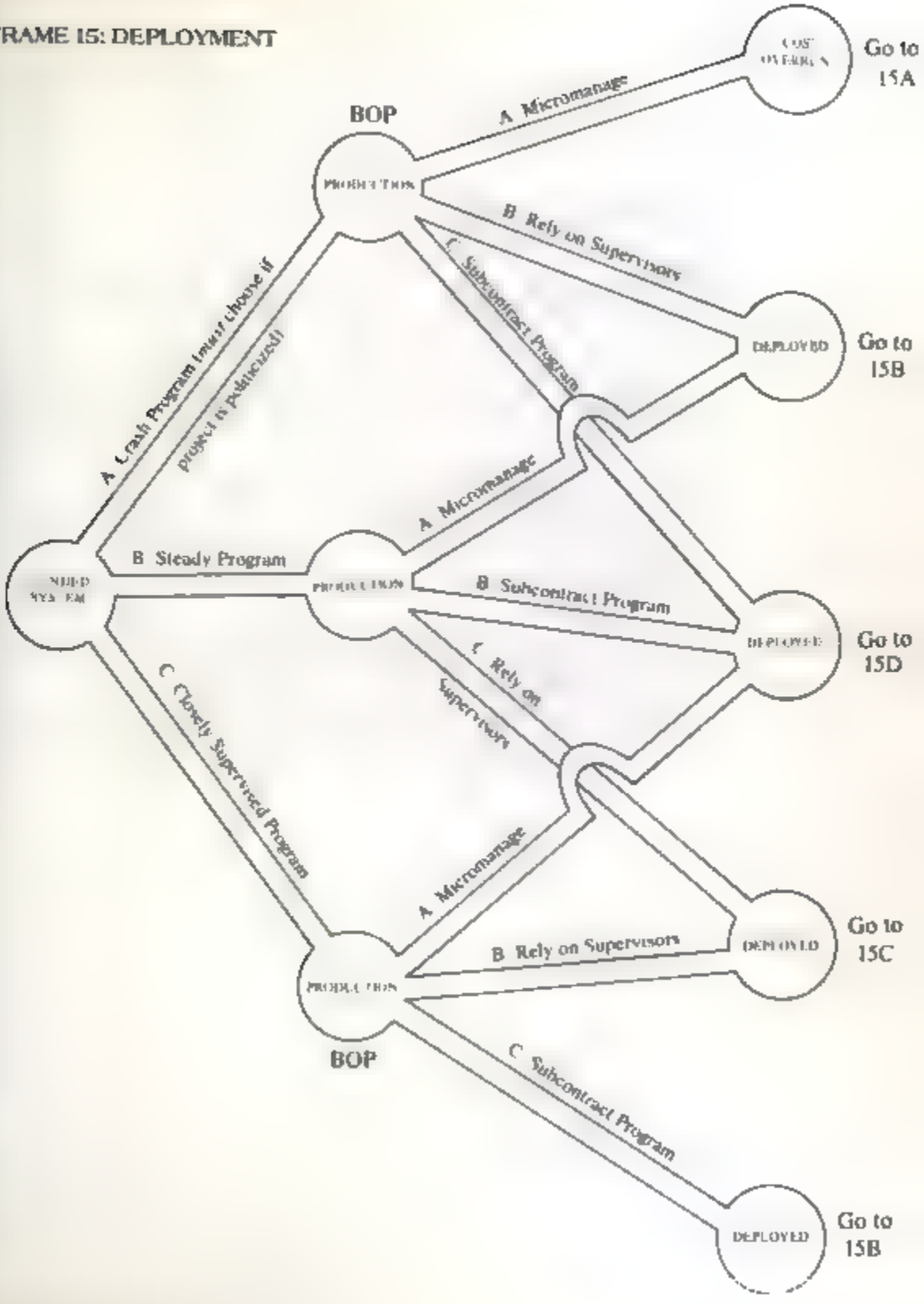
14A Although you have been responsive to the concerns of the congressional appropriation committees, ultimately there was inadequate political support to ensure the approval of your budget for production and deployment. The remaining opposition may be overcome by continuing to campaign in Congress for an appropriation. Return to the origin point of this frame.

14B Congress has appropriated all the money in your program request. Proceed to Frame 15.

14C Congress has passed your appropriation. Your own actions in responding to legislative concerns, however, have slightly increased the chances of difficulty arising in the final stage of the deployment of your hardware. Advance to Frame 15. On that frame you must add 1 to each dice roll you make using the DRT.

14D The committee turned out to be wiser than you thought and detected your effort to influence the decision through clever hacking. The project has no possibility of approval in its current form and must be redesigned. Return to production engineering. Move back to Frame 9.

FRAME 15: DEPLOYMENT



FRAME 15 EXPLANATION

15A. Despite all the careful preparations there have been serious cost overruns on the hardware program that reflects your original idea A congressional committee has decided to investigate your project Return to Frame 12

15B. Your idea has been successfully developed into deployed hardware with a production budget of $4 3 billion The game ends here You may proceed to determine your score

15C Your idea has developed so successfully that the deployed hardware if anything is even better than the original concept The government has increased its orders for the equipment to a total of $5 billion and you have been awarded a special achievement bonus of $50 000 The game ends here You may add 1 to your remaining idea value and then go on to calculate your final score

15D Your idea has been developed into deployed hardware but some of the imperfections in conception and implementation have translated into weaknesses in the hardware The government is funding production of the hardware at $6 billion, but half of that has been given to your competitors to correct the flaws in your original design The game ends here You must subtract 1 from your remaining idea value and may then determine your final score for the game

DECISION RESULTS TABLE

Modified Dice Roll	Turn Number 1–10	11–20	21–30	31–40	41–50	51+
0	Advance	Shift Up	Advance	Shift Up	Advance	———
1	Shift Up	Advance	Shift Up	Advance	———	Advance
2	Advance	Shift Up	Advance	———	Advance	Add 1
3	Shift Up	Advance	———	Advance	Add 1	Shift Down
4	Advance	———	Advance	Add 1	Shift Down	Advance
5	———	Advance	———	Shift Down	Advance	Shift Down
6	Advance	Add 1	Shift Down	Advance	———	Add 1
7	Add 1	Shift Down	Advance	———	———	Shift Down
8	Shift Down	Advance	———	Add 1	Shift Down	———
9	Advance	———	Add 1	Shift Down	Add 1	Advance
10	———	Add 1	Shift Down	Add 1	Advance	Shift Down
11	Add 1	Shift Down	Add 1	Advance	Shift Down	Add 1
12	Shift Down	Add 1	Advance	Shift Down	Add 1	———

Note Use two six-sided dice to derive a result for this table. Add the total but modify it for conditions imposed in the game. Modified results greater than 12 are counted as 12. Results less than 0 equal 0.

Special Dice Modifiers Add 1 to your dice roll if you are still on Frames 1–4 after the 20th turn of the game.

Result Key

———	Unsuccessful choice; turn lost. Try again.
Advance	Move ahead to the next node on the frame along the line of the letter decision you chose.
Shift Up	Advance to the next node of the frame by using the line of the letter decision that is now one *lower* than the one you chose. If you chose ... use A, and so forth. If your decision choice was a, there is no advance, and you must return to the origin node of the frame you are on.
Add 1	Advance to the next node of the frame using the line of the letter decision you chose. Add 1 to your *next* dice roll on the Old.
Shift Down	Advance to the next node of the frame. Use the line of the letter decision that is one *higher* than the one you chose on your last move. If you chose a, use b, and so forth. If your decision choice was z, there is no advance, and you must return to the origin node of the frame you are on.

CHAPTER 5

GAMES OF RISK

Computerized wargames challenge the limits of simulation logic and sometimes those of state-of-the-art hardware, while military maneuvers provide the closest thing to real war for large units of men in the field. At the opposite end of the simulation spectrum is a class of games that concern the broad sweep of international relations and casts players in the roles of national leaders. These are called "politico-military" games. Instead of conflict, they model *risk*—the risk of war, of disruption of alliances, of worsening relations with adversaries. Because politicomilitary games focus on potential outcomes of historical dimension and because they provide almost the only way for government policymakers to gain experience in managing crises short of actually sitting through them, these games are among the most important ones conducted in the United States today.

Politico-military games are not usually intended to identify a "best" action but to give the players some idea of how crises might begin and evolve in the real world. The players, who are drawn from the ranks of senior officials, are then (presumably) better equipped to deal with a real crisis if it should arise. Since these games involve decisions on committing military forces, they are generally associated with wargames, but they may or may not include detailed combat modeling. In either case they are an important part of the Pentagon's gaming program, and no discussion of conflict simulation would be complete without a look at the origin and structure of politico-military games.

Although games of risk are probably only a day younger than games of chance, the history of politico-military simulation is quite recent. For its invention and development we again owe much to the Rand Corporation. The initial innovation was made by Herbert Goldhamer soon after the corporation moved to its present location, a large pink edifice near the beach in Santa Monica, in 1953. Rand sent emissaries to describe the first game, called *Poker* (for *Political Exercise*), to a variety of military and civilian audiences. Between February 1955 and April 1956 Goldhamer ran the game four times with 59 players, devoting a total of three man-years to its play. There were two opposing teams plus a control group who decided what information to give the players and, in the tradition of the German free *Kriegspiel*, made all rulings regarding play outcomes. The players were given a scenario as the starting point for the game and then made decisions regarding national policy.

All who played *Poker* at Rand were enthusiastic about their experience. The new technique gained acceptance because it allowed the simulation of elements, such as diplomatic relations and police decisions, that had never before been included in games. *Poker* was run again in 1958 at the Massachusetts Institute of Technology by political scien-

tist Lincoln P. Bloomfield and Rand analyst Paul Kecskemeti (shortly before Kecskemeti got in trouble with the U.S. Congress for his work on a study of the military value of strategic surrender during war). It was also adapted for use in student training at Tufts University and was initiated in a more structured form by the *Inter-Nation Simulation* at Northwestern University in 1962. By that time, political-military gaming had arrived at the Pentagon, where it was conducted by the unit that became the Studies Analysis and Gaming Agency.

Rand moved on to design a game for simulating policy planning called *Strategy and Force Evaluation* (*SAFE*), which was run six times during 1961 and 1962 as part of a Pentagon-commissioned study of alternative strategies for major wars. This game was played by nine or ten persons, three each for the blue and red teams, the others constituting a control group. The teams began with nuclear forces that corresponded to the existing arsenals. Each team received a statement on basic policy, a budget level, and a list of procurement options based on technology in research and development. The object was to see how many and what types of nuclear forces might be procured by national leaders facing a strategic balance such as that of 1961.[4]

The *SAFE* games had a duration of about three weeks, during which a mere five turns were played, each representing two years of real time. The teams filed occasional war plans, which were used by controllers to get a feel for the capabilities being acquired, but, ironically, about ten hours were spent planning procurement for each hour put into war plans.

A retrospective analysis by Rand in 1975 attempted to learn from *SAFE* by comparing actual procurement policies during the 1960s with those formulated by the *SAFE* teams. This study showed that the blue (U.S.) teams spent a lot more on civil defense than did the U.S. government. Further, only two of the six blue teams chose to deploy missile defenses, whereas in reality the United States did pursue this option and was at the point of active deployment of ballistic missile defenses for a brief time in 1975. The Rand analysis also compared red team actions with Soviet ones. As was the case with blue, real-world developments had not been exactly predicted by the *SAFE* games.

Of course, risk simulations are hampered by the same problem of subjective inputs as combat models. The scenarios that start the games and the control groups which determine their progress use subjective inputs. Switching to a computerized model does not solve the problem because game designers and computer programmers must attempt to visualize all possible ramifications of a decision made at one point in time in order to model them. It is quite optimistic to suppose that this is possible.

One illustration of the army of difficulties that arise from such excessive subjectivity is the overly ambitious computerized game *TEMPER* (for "Technological, Economic, Military, and Political Evaluation Routine"), designed in 1966 and since abandoned. This game tried to computerize the control group—in addition to modeling military expenditure, foreign aid, research, production, alliance behavior, conflict regions, and political blocs—for each of 117 nations, all simultaneously. The wizard behind the design, Clark Abt, once told an official group of his ideal setup: "a system with fifteen buttons, five for each of the military political functions." That the process of world history could be reduced to 15 buttons on a computer keyboard is an enormous assumption!

In fact *TEMPER* was coolly received by the Pentagon. Setting up the game required determining literally thousands of input values for the 117 countries. Not only was the input subjective, with many numbers literally picked out of the air by operators running the game, but, in common with most computer games, hundreds of man-hours were necessary to prepare a 30- to 40-minute run of the game. The Pentagon commissioned two additional studies of the quality and suitability of *TEMPER* for its crisis simulation needs. One study found the game plausible, but the other found serious errors in the simulation logic and documented gaps in its required inputs and so recommended that the game be abandoned. It was.

Abt Associates was more successful with its game *Politica*, a simulation that stepped back from computer technology to follow the more common approach of reliance on a control group. *Politica*'s basic design was conceived on a hot summer afternoon in Cambridge, when the air conditioning had gone out at Abt's warehouse attic offices and analysts Martin Gordon and Daniel del Solar repaired to the former's apartment with two six-packs of beer. Over a casual conversation emerged several concepts for the social and political components of a novel simulation. Rather than modeling a national leadership, with teams representing a surrogate government, one player could be the leader, another the middle class, one the landowners, another

the military, and so on, up to a total of 35 players. Gordon then did the design work and del Solar the data analysis for inputs that Abt used for several test runs with university students. The Pentagon bought the game in the late 1960s for $100,000 and then classified it top secret. Del Solar later left the company but became convinced after September 1973 that *Politica* had been used in U.S. planning for the destabilization of Chile. This startling charge is not implausible given that such crisis games are often used to study tense situations in foreign countries. More recently, for example, Greece withdrew its officers from the study program at the NATO War College in 1984 after a crisis game played there featured a scenario that had the Greek government overthrown in a military coup.

The Pentagon's politico-military simulation effort is centered at the Studies Analysis and Gaming Agency. A political-military division of SAGA plans and conducts the games, which are more closely related to Rand's *Polex* than to Abt's *Politica*. Topics and settings for the games are selected by the Joint Chiefs of Staff. The SAGA experts then go to work, months in advance, to plan the actual exercise. Preparation often begins with familiarization trips by the experts to the chosen locale.

A vital first step is the creation of the game scenario. Studying the topic provided by the Joint Chiefs, SAGA staff members establish a list of events that might be likely to result in such a situation. Then they relate the events to each other as a timeline to guide the decisions of the control group. The scenarios, which may take as long as six months to prepare, are given to the teams when the games begin.

As the green team, the control group has the dominant role in SAGA crisis games. Team members take on the role of the timeline authority and create events that structure the problem facing the players. Sometimes green plays the opposition at the same time, a combination of avenger and *deus ex machina*.

There are two levels of play in a SAGA crisis game. Senior officials who have agreed to play make up a policy group that makes the top-level decisions for the team. The policy group may meet formally only once or twice in a game. In fact, these busy officials more often phone in for reports of game action or to register votes on a decision. The guidance goes to the second playing level, an action group that is in full-time session during the game. The action groups represent the working-level bureaucracy. They spend most of their time compiling the written forms filed to indicate each move. Seven steps of planning must be specified in turn to complete a form.

The action groups of the blue and red teams, plus the green team of controllers, meet in separate rooms, decorated in those colors, which the agency maintains at the Pentagon. Top-level command post exercises use actual headquarters, such as the National Military Command Center. It takes 35 to 40 players and controllers to make up a full-size crisis game. SAGA prefers top players who are four-star generals or civilian secretaries and their subordinates, but more often they get three-stars and deputy assistant secretaries. At times when the crisis games were less popular, participants tended to be self-nominated, and occasionally SAGA has gotten no generals at all.

The worst drawback for the players is the time involved. Although some NATO command exercises run overnight or end within a day, the SAGA games occupy a full workweek, the "crisis" unfolds at the rate of one move a day for three days, followed by two days for critiques and postmortems.

Politico-military crisis games have addressed many subjects. Some 50 "crises" were conducted by SAGA alone in the 25 years following their creation in 1952. These usually featured whatever problem seemed most pressing at the moment. In 1977, with the resurgence of interest in the terrorism problem, a SAGA setup had a band of terrorists seizing a nuclear weapon. In 1980, when the Iranian revolution and the American hostages in Teheran had turned all eyes to that quarter, the crisis game featured a Persian Gulf scenario. And a 1982 SAGA game looked at war resulting from a confrontation in Korea, southwestern Asia, and then Europe, a sort of crisis on all fronts.

Game scenarios mostly follow historical events, but on occasion they prefigure them. Such was the case with SAGA games on Vietnam. *Sigma I* was held in early 1963, before the commitment of U.S. troops to combat in Southeast Asia. The Joint Chiefs had ordered a game of the Indochina situation. General Maxwell D. Taylor served as leader of the red team's policy group. According to his action group director, William H. Sullivan, Taylor gave instructions for the surrogate guerrillas to accept high losses, ignore issues of truth, and exploit propaganda techniques. Taylor, who played a major role in shaping U.S. policy toward Vietnam,

was amused to fancy himself in the role of Ho Chi Minh and encouraged Sullivan to think of himself as Vietnamese commander Vo Nguyen Giap. Within the week, at a point on the timeline corresponding to 1972, red was active throughout Indochina and had tied down half a million blue troops in Vietnam.

In fact, the United States did become bogged down in Vietnam, and its war effort was about played out by 1972. More interesting yet, the number of U.S. soldiers in Vietnam peaked at precisely 549,500 in the summer and fall of 1968.

Evident success of the red team led to consternation in Washington and a conference at the National Military Command Center to review the lessons of the SAGA game. It happened that the Rand Corporation had assembled the rules for *Sigma I* and acted as the control team. Air Force generals leapt on this point and argued that the controllers had not given sufficient weight to airpower in the game. During the conference, an open argument between Air Force chief of staff General Curtis LeMay and President Kennedy's national security adviser was narrowly averted by a change of subject, but the controversy was enough that the Pentagon determined to repeat the simulation.

Accordingly, a *Sigma II* game was held in 1964. This time the policy group players included the men who had disputed earlier results, LeMay and McGeorge Bundy, as well as deputy secretary of defense John McNaughton and Army chief of staff General Earle Wheeler. The control group was different from before, and Air Force potential was deliberately given greater weight. Nevertheless, the results came out similar to those of *Sigma I*.

Not surprisingly, these results did not change any minds among top policymakers, who proceeded to move ahead with the deepening Vietnam involvement. Of all the top officials, only CIA director John McCone, who had played blue policy chief in *Sigma I*, shifted to a stance of opposing Southeast Asian intervention. Worse yet, rather than informing policy, the game results became only another disputed item between the contending factions of the bureaucracy.

Vietnam was a major crisis, but it has passed. A problem that is still around is nuclear weapons, decisions about which have figured in many crisis game scenarios. These games again illustrate the central role of control groups in the mock crises. During one NATO simulation in the late 1960s, action intensified until advisers were recommending resort to nuclear weapons. Harlan Cleveland, then the American ambassador to NATO, was playing the President. Cleveland was apparently appalled by the nuclear suggestion and rejected it sharply. Controllers immediately called NATO headquarters in Brussels, where commander in chief General Lyman L. Lemnitzer was acting as senior umpire.

"Lem" promptly phoned Cleveland back, using one of the control group lines. "Harlan," he exclaimed, "you can't do this, you'll ruin the entire exercise!"

In a "crisis" conducted by SAGA a decade later, the blue and red teams made a series of moves that were clearly intended to defuse the situation. The control group script, however, called for a nuclear confrontation, so the green team kept throwing up game developments that sharpened the crisis despite the moves of the other teams. The intention was evidently to force one side into threatening nuclear use. The controllers proved successful when the game ended in a nuclear war. Afterward, a key player complained to the game director, "If your control group had just left us alone, we could have negotiated a lasting peace!"

So, with some idea of where they wish to go, the controllers can force players in that direction. The structure of the crisis game is such that controller decisions, realistic or not, drive the player teams. This might not be important if the object of the crisis game were simply to arm senior decision makers with an understanding of the dimensions of some situations, but the *Sigma* games demonstrate that participants may learn little from the games. At the same time, the nuclear games show that even enlightened decision makers can be overrun by determined controllers. Crisis games, like other simulations, are too often of limited value in the role for which they are intended.

What of the present administration? One more game example is pertinent here, the 1982 SAGA game code-named *Ivy League*. In a departure from the usual practice, the policy group in this game met at the White House and was directly observed by President Reagan. *Ivy League* cast former secretary of state William P. Rogers as President and former CIA director Richard Helms as Vice President. The hypothetical crisis began in Korea and worsened until American warships were sunk by a Russian tactical nuclear weapon. Rogers made the decision to respond with a limited nuclear strike, but the game escalated into a major nuclear exchange. The President and his advisers were judged eliminated in a Soviet attack on Washington, but five subordinate commanders survived as blue com-

mand posts to carry out the destruction of the Soviet Union.

Ronald Reagan was the first sitting President to attend a crisis game since Dwight Eisenhower participated in one in 1960. Afterward, a White House official told reporter Richard Halloran, "After President Reagan watched someone face up to the decision to push the nuclear button, all of a sudden, there was a sensitivity that wasn't there before."

The politico-military games that simulate policy planning or crisis management are some of the most important games played in government today. They are designed to simulate the full ebb and flow of international relations, providing officers and policymakers with vicarious experience in the turmoil and tension of crisis. But games of risk are hampered by problems of subjective inputs identical to those of standard wargames. Human analysts still create the scenarios, making human judgments on which factors to include and what weight to attribute to them. Furthermore, the work of umpire teams during the actual running of the games adds another facet to the subjectivity problem. With complete authority over the events of a "crisis," we have seen controllers push the players in whatever direction they want, artificially structuring games to propel policy group players into decisions. In a standard wargame or military maneuver controlled by umpires, simulation of combat is at least a limited enough objective that rulings may be made with some basis in reality, but in a crisis game modeling the broad sweep of world politics, the reality is so complex that controllers stand on very soft ground indeed. In particular with nuclear crises, since a nuclear war has never occurred, the controllers have no basis for making "realistic" judgments.

The Joint Chiefs undoubtedly select their crisis game topics with a view toward understanding conflicts they see on the horizon. Yet game results often fare no better than the Pentagon's more common analytic studies. And, as the *Sigma* games on Vietnam showed, game results do not necessarily change minds. Moreover, like other kinds of studies, they become all too often just another disputed issue between factions supporting different policies. And because senior officials in policy groups participate only from time to time, games may even be of limited value in giving experience to policymakers. Those who gain the most experience are really the subordinates who play full-time in the action groups, but these mid-level officers have much less ability to influence policy.

Crisis games study risk but cannot measure it. Our politico-military games remain at a primitive stage of development. Indeed, except in the narrow sense of the vulnerability of troops to given weapons, the Joint Chiefs of Staff do not even have a definition for the concept of risk. Players may or may not take the games seriously. At the Pentagon's National Military Command Center, while waiting for the controller's ruling or the next game event, the generals tell their favorite war stories. At the State Department's Crisis Operations Center, the diplomats and military officers assigned there have been known to pull out a well-worn copy of the Milton Bradley children's game *Condriand*

GAME 3

LAST DAYS OF SAIGON: Playing to Break Even

This game employs the same sorts of concepts and basic approach as military simulations. The representation of terrain in a combat system and the quantification of unit firepower scores, as discussed in Chapter 4, can be seen here in graphic terms.

Last Days of Saigon departs from the military approach in several ways, however. It is specifically intended to be relatively easier and quick to play, an effect achieved by making no effort to progress beyond very abstract modeling of some of the more complex processes typically included in military games, such as weapon-versus-weapon interactions or combat air support. The fact that the subject lies in the past also facilitated data collection, avoiding many of the difficulties of hypothetical present and future simulations. Moreover, Vietnam was an insurgency war with limited forces and no nuclear weapons, which reduces the complexity of the simulation required.

In the standard military approach, the goal for each player is to eliminate the forces of the opponent. This is also different in *Last Days of Saigon*, where the South Vietnamese player's aim is to evacuate refugees and the North Vietnamese try to stop them. Combat with the adversary is important only as instrumental to those goals. This reflects the actual strategic situation of the final campaign of the Vietnam War.

HOW THE GAME WORKS

The game is set in 1975 during the chaotic final weeks of the Vietnam War, when the South Vietnamese government faced the critical problem of evacuating its personnel and dependents while the North Vietnamese were pressing forward in a final offensive. The game can be easier than many on the Vietnam War because guerrilla warfare had basically ended by this point and thus need not be included. In addition, naval and air activities can be portrayed in a general fashion, while resolution of ground combat is at a division and regiment level. Further, rather than the whole theater of the Vietnam War, *Last Days of Saigon* features only the southern portion of the country, which figured in the final offensive. These characteristics make this an "operational-level" wargame.

This simulation is intended for two players, although it can be played solitaire without difficulty. Players have sets of pieces that represent the forces available to both sides. Some pieces arrive after the beginning of the game as reinforcements. The object for the South Vietnamese player is to hold long enough to perform a successful evacuation. The objective of the North Vietnamese player is to prevent this by capturing cities as quickly as possible. *Last Days of Saigon* can be played in two or three hours.

The rules govern the actions and capabilities of both sides. Because the rules constrain the players and provide the guidance for all potential situations

that can arise from game action, they may at times appear overly complex, but the game itself is accessible to all

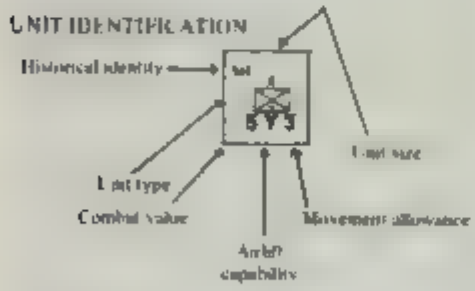
Game Components

The game map is printed on one side of a fold-out page toward the end of this book. This page is the board on which *Last Days of Saigon* is played. A set of playing pieces or "counters" is bound into the back cover of this book. The counters are coded with the capability information for each unit and its historical identity. The counters are placed on the mapboard before the start of the game according to a list, or "scenario" in the wargame jargon, printed at the end of these rules.

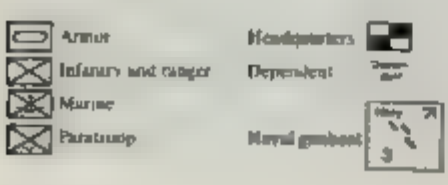
The mapboard is a terrain map of part of South Vietnam. It covers the regions around Saigon and the Mekong delta. The map has been superimposed with a hexagonal grid (hereafter referred to as "hexes") to regulate movement and combat in the game. The mapboard page also contains important play information such as the Combat Results Table and the Terrain Effects Chart.

Players of *Last Days of Saigon* must separate the game pieces from the parts sheet included in this book and must also provide one six-sided die to generate random numbers for use with the Combat Results Table. Printed in the text following the scenario is a full-page illustration of the game parts sheet, both upper and lower faces, which are to be used as a physical record of the identities and ratings of pieces.

UNIT IDENTIFICATION



UNIT TYPES



UNIT SIZES

XX Division (6000–10,000 men)
X Brigade (3000–5000 men)
III Regiment (1000–1500 men)
II Battalion (500–1200 men)

COMBAT VALUES

A combat value in parentheses—for example, "South Vietnamese (2)—5 Armored Cavalry Regiments"—is for defense only; these units cannot attack.

GAME ABBREVIATIONS

CRT	Combat Results Table (used to resolve battles)
Dep	Dependents
DRV	Democratic Republic of Vietnam (North Vietnamese player)
GVN	Government of Vietnam (South Vietnamese player)
HQ	Headquarters
JGS	Joint General Staff (South Vietnamese high command)
MR	Military region (South Vietnamese corps command)
NLF	National Liberation Front (Viet Cong guerrillas)
PFF	Police field force (South Vietnamese paramilitary force)
RDP	Regional force/Popular force (South Vietnamese militia)
Rngr	Ranger (GVN light infantry units)
TEC	Terrain Effects Chart (used to determine movement and combat effects of terrain on the map)
VNAF	South Vietnamese Air Force
VNN	South Vietnamese Navy
ZOC	Zone of control (area dominated unit on mapboard)

RULES OUTLINE

I. Object of the game

II. Setting up the game

III. Play
- 1) Sequence of play
- 2) Movement
- 3) Stacking
- 4) Zones of control
- 5) South Vietnamese evaluation

IV. Combat
- 1) Combat play
- 2) Explanation of combat results
- 3) Examples of combat

V. Modifiers
- 1) Command control
- 2) Senior supervisors
- 3) Replacements
- 4) Reinforcements
- 5) Vietnamese Air Force
- 6) GVN demoralization

VI. Last Days of Saigon scenario

Winning the Game

Victory is achieved on the basis of points in *Last Days of Saigon*. One point is scored for each turn that the South Vietnamese player continues to control either Saigon or Cholon or both. A point is also scored for each Dependent piece and Headquarters counter that is successfully evacuated. These points are totaled at the end of the game and define the outcome, which can be a draw, or a marginal or strategic victory for either player. A "Victory Point Schedule" is printed in the game scenario that specifies the number of points required for each possible outcome.

Setting Up the Game

Lay out the mapboard on a table and separate the pieces into the set of these to be used by each player. Refer now to the scenario listing. Under its "Setup" category the scenario lists towns on the mapboard and for each entry details the pieces that must be placed at that location. In most cases the pieces must be placed in the town, although occasionally a listing provides the player with some choice of exact placement within a certain distance (stated in numbers of hexes) from a town. The South Vietnamese player sets up first, followed by the North Vietnamese player. Remember to provide one six-sided die for use in combat resolution. The game can now begin.

Sequence of Play

Last Days of Saigon is played in game turns subdivided as follows. The game continues for 12 turns or until the fall of Saigon and Cholon, whichever comes first. Each full turn includes a "player turn" for both participants. During each turn the North Vietnamese (hereafter "Democratic Republic of Vietnam" or DRV) player takes his player turn first, followed by the South Vietnamese (hereafter "Government of Vietnam" or GVN) player. Player turns consist of two segments as follows:

Movement Segment. The player may move any, all, or none of his pieces within the constraints of the rule on movement. During this segment the player also consults the scenario to determine whether any new pieces (reinforcements) arrive on this turn. If so, reinforcement pieces are placed at the location specified and may move normally. During this segment of any GVN player turn, the player may also remove Dependent pieces or Headquarters from the game according to the rules for evacuation. After all movement is completed, the player proceeds to his combat segment.

Combat Segment. Combat may occur between pieces or stacks of pieces located on hexes adjacent to each other. Each battle is resolved by totaling the strength factors of the units involved and following the steps indicated by the rule on combat. Either or both players may "support" a given combat by using their air units (see p. 72). Combat is voluntary and does not occur unless initiated by the moving player. Each battle is resolved separately in the order desired by the player conducting the engagement. With the completion of the last desired battle, the player turn is finished, and the opponent takes his player turn. At the end of each GVN player turn the "Game Turn" marker, which should be placed on the "Time Record Track" printed on the mapboard page, should be moved ahead to signify passage of time.

Movement

Players may move any, none, or all of their pieces during each friendly movement segment in order to execute their game strategy. Except as noted below for special cases, all pieces move through the mapboard grid, from hex to adjacent hex, with each unit expending points from its printed movement allowance as required to enter each type of terrain on the map. The cost in movement allowance of entering each type of terrain hex is specified by the Terrain Effects Chart (TEC) printed opposite the mapboard page of this book.

All terrain costs are cumulative. If crossing a river to enter a hex, for example, the unit must pay the costs of both the river and the hex it is entering. A unit cannot enter a hex if it does not have sufficient remaining movement allowance to pay all associated terrain costs. Roads negate the costs of other terrain in a hex for units following the road in their movement.

Units may move freely through hexes containing other friendly units. Within the limits of stacking, units may also stop on hexes containing friendly units. No piece can ever enter or move through hexes containing the opponent's units.

Each unit can expend all or any portion of its movement allowance during each friendly movement segment. Units may not accumulate unused movement allowances from turn to turn, nor can

they transfer unused movement points from unit to unit. Each unit moves independently with its own movement allowance.

Movement Restrictions. Tank units ( ) may enter jungle hexes only when following roads. Except for Paratroop ( ), Marine ( ), and Ranger ( ) units, GVN pieces may enter swamp hexes only when following roads.

Movement Prohibitions. GVN pieces with zero movement allowances are "popular forces" militias and, once placed on the map, may never move. GVN Dependent ( ) and Headquarters units ( ) also may not move (*exception*: the Vietnamese Navy Headquarters may move by sealift only) except in an evacuation, when they are removed from play.

Sealift. Four port hexes (Phan Thiet, Vung Tau, Cholon, Saigon) are marked on the map with small anchor symbols. The GVN player may move one piece at each turn among any of these ports. To be sealifted a unit must be capable of movement (*exception*: Vietnamese Navy Headquarters) and must begin the turn at a port. A sealifted unit may not move further in that turn after displacing to another port.

In addition, the GVN player has certain specialized naval capabilities. A Naval Gunboat piece [ ] can move at each turn to any coastal hex or any hex adjacent to a river hexside. This piece has a triangular indicator in its upper right-hand corner, and the unit is placed so that the indicator points at the river or sea hexside that is actually occupied. GVN Marine units ( ) may then be sealifted from their port hex to the hex occupied by the Naval Gunboat. This capability is in addition to the normal sealift quota of one unit per turn.

The GVN player retains his sealift ability only as long as the Vietnamese Navy Headquarters remains in play. Should the Headquarters be eliminated or evacuated, further sealift or Naval Gunboat movement is prohibited.

Airlift. The GVN player has units of Paratroops ( ), Rangers ( ), and Marines ( ), which are capable of being airlifted. This capability is denoted by a small symbol (Y) printed on the unit counter between its combat strength factor and its movement allowance. At each turn the GVN player may airlift up to three of these units from any town hex to another town hex containing friendly units or from any airbase hex to any clear terrain hex on the mapboard. A unit that is airlifted can conduct normal ground movement following its lift. Airlifted units cannot land in hexes covered by the opponent's zones of control unless the hex is already occupied by other friendly units. The GVN player retains his airlift capability only for as long as he still controls at least one airbase hex *and* the Vietnamese Air Force Headquarters remains in play.

Stacking

Both players are allowed to have more than one piece in any given hex. This is termed "stacking." The DRV player may stack up to four units in any one hex. The GVN player can have up to five units stacked in a hex. The GVN Naval Gunboat, Dependents, Headquarters, and both players' air units do not count as a unit when stacking, and therefore may be stacked without limit.

Zones of Control

Each combat unit in *Last Days of Saigon* is considered to have a zone of control (ZOC) that extends into the six hexes immediately surrounding the one occupied by the unit. Opposing units that enter a ZOC-covered hex must halt their movement and may not move any further during the current game turn. Units that *begin* their movement segment in the opponent's ZOCs *may* move to an adjacent hex that is also covered by a ZOC and then halt, or they may exit the ZOC to a hex not so covered and then move freely. ZOCs of South Vietnamese units never extend into swamp hexes. Naval Gunboats, air units, Headquarters, and Dependents are not considered "combat" units and do not have zones of control.

South Vietnamese Evacuation

One of the critical game objectives of the GVN player is the successful evacuation of dependents and assorted key elements of the South Vietnamese government and armed forces. To reflect this in *Last Days of Saigon*, the game contains a number of pieces marked "Dependents" and also Headquarters (HQs) of the GVN and its forces. The player may declare an evacuation during his movement segment on any game turn. Beginning the fol-

lowing turn. Then continuing throughout the game the GVN player may evacuate Dependents and Headquarters at the rate of one for each evacuation site for each turn he retains control of these. The GVN player simply removes the HQ or Dependent counter from play during his movement segment. At the end of the game, each HQ or Dependent counter successfully evacuated counts as one toward the victory point level.

Evacuation Priority. All Dependent pieces must be evacuated before any Headquarters can be removed from play.

Evacuation Sites. There are three evacuation sites in the game: the ports of Saigon and Cholon and the airbase at Tan Son Nhut. The GVN player has an evacuation capacity of one counter for each site he controls during the movement segment of his turn. To control a site, the player must have been the last one physically to occupy or move through the evacuation site hex. Control of each site is determined separately. Loss of a site reduces evacuation capacity by one as control of the site passes from the GVN player to his opponent.

Evacuation Procedure. The GVN player determines his remaining capacity, chooses the Dependent and HQ units he desires to evacuate, and then removes these pieces from play. The priority of evacuating Dependents must be followed at all times. The GVN player may voluntarily evacuate pieces using less than his current capacity. Unused capacity cannot be accumulated or used in a later movement segment.

Evacuation Units. Only Dependent and Headquarters units are eligible for evacuation; no other pieces may be voluntarily removed from the game. The scenario locates most of these units at Saigon or Cholon at the start of the game. To prevent crowding of pieces on the Saigon and Cholon city hexes, a special holding box appears on the mapboard, within which evacuation-eligible units can be held until successfully taken from play. Evacuation-eligible units cannot move (*exception*: Vietnam Navy HQ *may* move by sealift only) and have no combat strength value. Evacuation-eligible units are captured by the DRV player if the hex they occupy is entered by the DRV player's combat units, if GVN combat units accompanying them are eliminated in combat, or if accompanying GVN units are forced to retreat as a result of combat.

Evacuation Effects. Beginning with the turn during which the GVN player declares his evacuation, an adverse penalty applies in the resolution of combat. In all subsequent attacks the DRV player may add one (1) to his basic die roll in each use of the Combat Results Table.

Command Control

Forces must maintain good communications and remain under control of their Headquarters in order to exercise their full capabilities. Proper command control is considered automatic for all North Vietnamese units. South Vietnamese units have the following command restrictions:

Ground Units. All ground units (including Marines and Paratroops) trace command to any of three Headquarters: the Joint General Staff (JGS), Military Region III (MR III), or Military Region IV (MR IV). If all these HQs are evacuated or captured, control of ground units is lost, and these may no longer move. Combat capability remains unaffected.

Naval Gunboat. The Naval Gunboat traces command to Vietnamese Navy (VNN) Headquarters. If this HQ is captured or evacuated, the gunboat may no longer move, but its combat capability remains unaffected.

Air Units. The air strike units trace their command to Vietnamese Air Force (VNAF) Headquarters. If this HQ is evacuated or captured, air units may no longer fly missions from the airbases and are eliminated from play.

Government Leaders. All forces *and* HQs in the game ultimately trace their authority to South Vietnamese Government (GVN) Headquarters. If this HQ is evacuated or captured, a die roll penalty is applied to all subsequent combat. The GVN player must thereafter subtract 1 on each use of the Combat Results Table, and the DRV player may *add* 1 whenever he uses the CRT.

Capture and Evacuation of Headquarters. HQs are not combat units and have no combat value. The North Vietnamese player captures an HQ if he captures the hex where it is located, either through combat or, if the HQ is alone in a hex, simply by entering that hex with combat units. Headquarters pieces cannot move except to be evacuated (*excep-*

tion. South Vietnamese Navy HQ), but HQs need not be physically located at an evacuation site in order to be evacuated. Simply remove the evacuated HQ from the map and take it out of play. The evacuation of HQs is, however, still subject to the South Vietnamese player's evacuation capacity, which remains dependent on the control of evacuation sites on the mapboard. The total number of HQs and Dependent pieces evacuated during any turn cannot exceed the South Vietnamese player's current evacuation capacity.

Combat

Battles are initiated by the moving player during the combat segment of his turn. Battle is voluntary but may only occur among units and groups of units located on hexes adjacent to each other. The player may engage in as many battles as he is capable of but is not required to do so. All of the opponent's units located in a single hex must be engaged as a single group. The moving player's units on different hexes may combine to engage the same opposing hex. Battles are resolved according to the rules below. In these rules the moving player is called the "attacker," and the opponent is termed the "defender." Battles are resolved in any order desired by the attacker.

Statement of Attack. The attacker begins with a statement indicating what hex is being attacked, from which adjacent hexes, and with a figure for the total number of combat strength points (including air units) in the attack. Combat values in parentheses count for defense only.

Defense Determination. After hearing the statement of attack, the defender decides whether he will support the engaged hex with any air units he may have available. He checks the terrain inside the engaged hex and consults the Terrain Effects Chart (TEC), printed on the mapboard page, to see if any modifiers apply to the combat value of defending units. The defender totals the resulting strength of all units and supporting air.

Other Modifiers. Die roll modifiers may have to be added in favor of the DRV player if an evacuation has already been declared or if the GVN Headquarters piece has been removed from play. These die roll additions are cumulative. A die roll subtraction may have to be made in an attack by the GVN player if the GVN Headquarters has been removed from play. A column shift may have to be applied when using the Combat Results Table if either player has armor superiority over the opponent. [For explanations of each of these modifiers see under the heads "Evacuation Effects" (p. 69), "Government Leaders" (p. 69), and "Armor Superiority" (p. 71).]

Final Resolution. Establish all modifiers that will apply to the battle outcome. Take the total combat value of both opposing forces and subtract the total of the defender from that of the attacker. Find the column on the Combat Results Table (CRT) that corresponds to the result of this subtraction. Apply any column shift that is appropriate. The attacker then rolls one die to generate a random number. Apply any appropriate die roll modifiers to this result. Take the adjusted die roll result and find that number on the CRT column. In the box corresponding to that number result on the CRT column, the players will find the result for the battle in progress. The specified result is applied immediately, before any further battle is resolved. (Explanations of each possible combat result appear in the section headed "Combat Results Explanation" on page 71.)

Steps of Strength. All units with a combat value greater than 1 have two "steps" of strength. These pieces have both upper and lower faces, with the latter showing a reduced strength. Whenever losses are required by combat, a full-strength (upper-face) unit is flipped to its reduced-strength side. A unit already showing its lower face is eliminated.

Retreat and Advance after Combat. Most combat results require the player with the weaker overall combat value to retreat following combat. Such retreats have a length of two hexes, with the direction chosen by the owning player. Units cannot retreat into or through hexes occupied by the opponent's units or covered by his ZOCs unless the hex is already occupied by friendly units; nor can they go into Cambodia, into the sea, across rivers, or into terrain they would not be able to enter during normal movement. Units with no movement allowance also cannot retreat. A stack that is unable to retreat under these guidelines suffers one additional step loss and remains in place. Whenever opposing units are forced to retreat after combat, the player's own pieces may advance into and occupy any hexes vacated by the opponent.

Combat Results Explanation

Find the column to use on the CRT by subtracting the total strength of the defender from that of the attacker. In all cases, CRT results apply to the weaker force. If the attacker's combat value is weaker than that of the defender, use the column corresponding to that difference. In this case the combat result will apply *to the attacker*. If both sides in a battle are exactly equal in total combat value, the result will apply *to the defender*. The following define the outcomes possible on the Combat Results Table:

Outcome	Explanation
— —	No effect
Back 2	All pieces of the weaker player must immediately retreat two hexes within the guidelines.*
Exchange	Each of the pieces belonging to the weaker side suffers a one-step loss. Remaining pieces must retreat two hexes within the guidelines. The stronger player must incur losses among his participating units with a force combat value (disregarding terrain modifications or strength of units equal to the number of factors lost by the opponent.
½ Exchange	Each of the pieces of the weaker side suffers a one-step loss and remaining pieces must retreat two hexes within the guidelines.* The stronger player must incur losses among his participating units equal in combat value to one-half the number of factors lost by the opponent (disregard terrain modifications to strength, round down and ignore fractions).
Loss	Each piece of the weaker player suffers one step of combat losses. Surviving units must retreat two hexes within the guidelines.

* See "Retreat and Advance after Combat," page 70.

Armor Superiority

Either player may have an advantage in battle if he is using armored units (▭) and the opponent is not. If the player with armor is the stronger player, shift one column to the right when using the Combat Results Table. If the weaker player has armor superiority, shift one column to the left on the CRT. If both players have armor in a battle, there is no effect. Armored cavalry units (▭) used by the GVN player have only light equipment, are not tank units, and do not generate armor superiority. The presence of GVN armored cavalry units does, however, negate the effect of armor units that may be present among the DRV player's forces in a battle.

Examples of Combat

Example 1. The DRV player declares an attack on a mountain hex adjacent to the town of Xuan Loc. He attacks with eight units, including one armored unit, with a total combat value of 35 strength points. The GVN player defends the hill with four units whose combined strength totals 11 points. This strength is doubled to 22 due to the mountainous terrain but is composed entirely of infantry and paratroops. The GVN player decides to support his defenders with one air unit, raising his overall strength to 30 points. Finding the difference in strength (35 − 30 = 5), the DRV player is the stronger, and the CRT column designated is the 0–7 column. This is shifted one to the right for DRV armor superiority, so the 8–12 column is the adjusted level. A die roll of 5 by the DRV player generates a "Back 2" result. The GVN player retreats all his pieces two hexes.

Example 2. The DRV player declares an attack against Saigon from four surrounding hexes with 12 units, including a tank regiment, totaling 73 combat strength points. The GVN player holds both Saigon and Cholon. In Saigon are five units, including an armored cavalry unit, with a combat value of 15 points. This is tripled to 45 points for defending a city. The GVN player supports his defenders with one air unit, raising his overall strength to 53. The difference in values (73 − 53 = 20) yields the 20–22 column of the CRT. Potential DRV armor superiority is canceled by the presence of the GVN armored cavalry unit. This battle takes place after a declaration of evacuation by the GVN player, so 1 is added to the DRV player's die roll. A roll of 1 leads to an adjusted result of 2, which is an "Exchange." Each GVN unit suffers a loss, the DRV player takes losses on units that total 15 combat strength points. The GVN player is able to retreat his surviving units through Cholon due to the presence of other GVN units in that city, which negate DRV zones of control for purposes of this retreat.

Replacements

Only the North Vietnamese player benefits from the ability to replace losses suffered. In this game the

DRV player may replace one strength step of units on each turn. Replacement takes place during the movement segment of the player turn. The DRV player simply chooses a reduced-strength unit and reverts it to its full-strength face. Replacements cannot be used to re-create units that have been completely eliminated in the game. Replacements can be accumulated unused for integration into reduced units during future game turns.

Reinforcements

Both players receive some new pieces in the course of the game. The scenario portion of the text contains a list of the number of pieces that arrive, their types, and a location from which they appear. Reinforcements arrive during the movement segment of the player turn. The new units may move and engage in combat from their turn of arrival.

Vietnamese Air Force

The South Vietnamese Air Force (Headquarters VNAF) is composed of four air units in addition to its HQ. These air units may intervene at the instant of combat to support the player's units in both attack and defense. Each air unit can be used once in *each player turn*, including the opponent's turn. The air units are subject to the command control of VNAF Headquarters. The air units are also *based* at three airbases printed on the mapboard (Bien Hoa, Tan Son Nhut, Soc Trang). For each airbase that is captured by the DRV player, one air unit must be removed permanently from play. When the last airbase falls, all remaining air units are eliminated. Air units that are carrying out missions in the same combat segment during which their airbase is captured may continue to complete their missions. They are then taken out of the game.

The North Vietnamese player also has an air force. Air units for the DRV player arrive as reinforcements in the course of play. DRV air units operate exactly the same way as other air units, except they are considered to be based off the mapboard and are not subject to airbase attrition.

GVN Demoralization

When the war situation worsened critically, South Vietnamese forces began to look over their shoulders, and morale collapsed. To reflect this in *Last Days of Saigon*, the GVN player suffers a penalty each time a town, city, airbase, or administrative center is captured by the North Vietnamese as the result of an actual combat. The combat loss penalty is that the GVN player must either reduce one 2–3 infantry unit to the status of a (1)–0 popular forces "static militia" or the GVN player may remove from play one of the popular forces (1)–0 pieces.

SCENARIO *LAST DAYS OF SAIGON*

March 29–May 26, 1975
(12 game turns)

SITUATION: North Vietnamese forces and local guerrillas have already overrun the central and northern regions of the GVN. A few remnants of government forces successfully evacuated from the previous debacles are refitting in several towns. The government of South Vietnam still retains control of its forces around Saigon and in the Mekong delta, Military Regions III and IV. The DRV armies have massed for the final offensive against Saigon and are about to attack. Other North Vietnamese forces are hurrying south to join in the action. The government of South Vietnam faces the imminent necessity of evacuating its dependents and key elements.

INITIATIVE: The South Vietnamese (GVN) player sets up his pieces first. The North Vietnamese (DRV) player moves first.

GVN PLAYER SETUP

- Saigon-Cholon (place in holding box to side of board): 7x Dependent pieces, GVN Headquarters; 1x 3–5 Armored Brigade, 1x 2–5 Armored Cavalry Regiment, 3x (2)–3 Police Field Force regiments, 1x 2 Y 3 Ranger Group; 2x 1–3 Infantry Division remnants.
- Phan Thiet: 1x 2 Y 3 Ranger Group
- Within one hex of Xuan Loc: 1x 5 Y 3 Paratroop Brigade; 3x 2–3 Infantry Regiments
- Trang Bom: 1x 3–5 Armored Brigade, 1x 2–5 Armored Cavalry Regiment
- Ham Tan: 1x 3–3 Infantry Division
- Vung Tau: 1x 4–3 Infantry Division, VNN HQ

- Long Binh: 1x 4 Y 3 Marine Brigade
- Bien Hoa: 1x 2 Y 3 Ranger Group; MR III HQ
- Tho Duc: 1x 5 Y 3 Paratroop Brigade
- Tan Son Nhut: JGS, VNAF HQ
- Any town within *two hexes* of An Loc: 3x 2–3 Infantry Regiments
- Any town within *three hexes* of Tay Ninh: 1x 6–3 Infantry Division
- My Tho: 1x 6–3 Infantry Division
- Can Tho: 1x 2–5 Armored Cavalry Regiment, 1x 2 Y 3 Ranger Group; MR IV HQ
- Any town within *two hexes* of Can Tho: 3x 2–3 Infantry Regiments
- Any town within *three hexes* of Can Tho: 1x 6–3 Infantry Division
- Any town within *two hexes* of another town that is occupied by another GVN unit: 9x (1)–0 Popular Force units
- For general use: 4x 8-factor Air Units, 1x 3-factor Naval Gunboat

NORTH VIETNAMESE PLAYER SETUP

- In mountain hexes within *two hexes* of Bao Loc: 3x 8–4 Infantry Divisions, 4x 2–4 NLF Regiments, 1x 3–6 Armored Regiment
- Any hex within *two hexes* of the town Loc Ninh: 4x 8–4 Infantry Divisions, 2x 2–4 NLF Regiments, 1x 3–6 Armored Regiment
- Any hex in Cambodia: 2x 8–4 Infantry Divisions
- Any swamp hex *three hexes* or more distant from Can Tho: 1x 8–4 Infantry Division; 5x 2–4 NLF Regiments

REINFORCEMENTS LISTING

A NORTH VIETNAMESE

- Turn 1: 1x 8–4 Infantry Division, 2x 2–4 NLF Regiments (*two hexes* north of the town Phan Thiet)
- Turn 2: 2x 8–4 Infantry Divisions (Bao Loc)
- Turn 3: 1x 8–4 Infantry Division (Bao Loc)
- Turn 4: 1x 8–4 Infantry Division, 2x 2–4 NLF Regiments (Loc Ninh)
- Turn 5: 1x 8–4 Infantry Division (Phuoc Binh); 1x 8-factor Air Unit (off the board)
- Turn 6: 2x 8–4 Infantry Divisions, 1x 3–6 Armored Regiment,* 1x 8-factor Air Unit (off the board)
- Turn 7: 1x 8–4 Infantry Division, 1x 3–6 Armored Regiment*
- Turn 8: 3x 2–4 NLF Regiments (Loc Ninh)

* At entry Hex A

B SOUTH VIETNAMESE

- Turn 1: 2x (1)–0 Popular Force static units (any town not yet captured by DRV player)
- Turn 2: 2x (1)–0 Popular Force static units (any administrative center)
- Turn 3: 1x 4 Y 3 Marine Brigade (Vung Tau), 3x (1)–0 Popular Force static units (any town not yet captured)
- Turn 4: 1x 2 Y 3 Paratroop Battalion (Tho Duc), 1x (1)–0 Popular Force static unit (any administrative center)
- Turn 5: 1x 4 Y 3 Marine Brigade (Vung Tau), 3x 2 Y 3 Ranger Groups (Saigon); 1x (1)–0 Popular Force static unit (any town not yet captured by DRV player)
- Turn 6: 1x (1)–0 Popular Force static unit (any administrative center)
- Turn 7: 2x (1)–0 Popular Force static units (any town not yet captured by DRV player)
- Turn 8: 2x (1)–0 Popular Force static units (any administrative center)

VICTORY POINT SCHEDULE

Last Days of Saigon continues for 12 game turns or until the DRV capture of both Saigon and Cholon, whichever comes first. After that time add up the number of game turns that have occurred and the number of Headquarters and Dependent pieces successfully evacuated by the South Vietnamese player. This total is compared to the following list to indicate the winner

20 points or less	DRV	strategic victory
2 points	DRV	marginal win
22-23 points	Draw	
24 points	GVN	marginal win
25 points	GVN	strategic victory

TERRAIN EFFECTS CHART

Type of Terrain Hex	Movement Cost	Combat Effect
Clear	1	None
Road	½ (if following)	(other terrain)
Jungle	2	Defender doubled
Swamp	2	Defender doubled
Mountain	2	Defender doubled
River Hexside	2 (if crossing)	Defender doubled if all attacking units across river
Town	1	Defender doubled
Administrative center	1	Defender tripled
Airbase	1	Defender tripled
City	1	Defender tripled
Port	(other terrain)	(other terrain)

All movement costs are cumulative; where more than one terrain effect applies, the defender chooses which he will use for combat resolution

COMBAT RESULTS TABLE

Adjusted Die Roll	Difference in Combat Values (Attacker minus Defender)								
	0–7	8–12	13–15	16–17	18–19	20–22	23–26	27–33	33+
0	[illegible]	-	[illegible]	—	—	Back 2	Back 2	Exchange	Exchange
1	[illegible]	[illegible]	—	-	Back 2	Back 2	Back 2	Exchange	½ Exchange
2	[illegible]	[illegible]	-	Back 2	Back 2	Exchange	Exchange	Exchange	½ Exchange
3	[illegible]	[illegible]	Back 2	Back 2	Exchange	Exchange	½ Exchange	½ Exchange	Loss
4	—	Back 2	Back 2	Exchange	Exchange	½ Exchange	½ Exchange	Loss	Loss
5	Back 2	Back 2	Exchange	Exchange	Exchange	Exchange	Loss	Loss	Loss
6	Back 2	Exchange	Exchange	½ Exchange	½ Exchange	Loss	Loss	Loss	Loss
7	Exchange	Exchange	½ Exchange	½ Exchange	Loss	Loss	Loss	Loss	Loss
8	Exchange	½ Exchange	½ Exchange	Loss	Loss	Loss	Loss	Loss	Loss

If attacks are made at less than a 0 advantage use the column corresponding to the superiority of defender over attacker and combat results then *apply to the attacker*. Columns may have to be adjusted for armor superiority (p. 71), die rolls may have to be adjusted for evacuation effects (p. 69) or for loss of GVN command control ("Government Leaders," p. 69).

CHAPTER 6

THE WARGAMES MYSTIQUE

The beginnings of wargaming are still shrouded in the mists of time. In the more recent past, there was tremendous growth in use of the games for military education during the nineteenth century, and the Franco-Prussian War marked a new beginning for games as "simulations." Seventy years later, World War II provided a quantum leap in demonstrating their utility. In broad terms, the popularity of wargaming in the American military has been cyclical since the war. There was an early burst of effort after 1945, a hiatus, and then a crest toward the end of the 1950s. Wargaming was eclipsed to a degree by systems analysis in the McNamara Pentagon of the 1960s, and both of these methods were out of favor a decade later. A revival of interest has occurred since the mid-1970s, and today we are riding the wargame cycle toward a new crest.

The new wave of interest is visible in several places. Instrumented battle simulations are the most dramatic, expensive example; the talk is of multiplying them and making them even more sophisticated. Other examples are the flourishing think tanks that specialize in wargaming, and the existence of a simulation center at the National Defense University. Many projects to create new wargame models are under way, including the use of such advanced concepts as artificial intelligence programs for computers. There are projects to create professional "Red" teams for wargame play, and some experts advocate such a team for each U.S. "unified" (theater) command. Encouraged by such efforts as the Air Force's Project Warrior, even commercial wargames are being used by the military to an unprecedented degree.

In the wider society there are reverberations of the resurgence of wargames. A heroic British paratroop major in the Falklands war was identified as an "avid wargamer," and popular doomsday movies feature Pentagon computer games gone wild. Words like *scenario* from the gaming jargon have entered into general usage. The idea of gaming, especially in the form of computer games, has seized the popular imagination.

To appreciate wargames, however, we need some criteria, some context in which to think about games. For wargame techniques exceed their purpose when the simulation results are used to justify policy, and they exceed their value when the desire for game experience begins to drive hardware innovation or when participants are misled into the notion that wargame experience is equivalent to real experience.

It is undeniable today that simulation techniques have penetrated into every aspect of Pentagon planning, both within the armed services and among them. There are combat simulation models and crisis games, nuclear maneuvers and command post exercises. Somewhere in the whirr of the computers, amid the reams of printouts and flashing colors on the CRT screens or for the public, in the millions of dollars spent, wargames have acquired a

mystique—an illusion that game results, in the form of computerized data, "prove" the validity of the simulations. The illusion is no more than smoke and mirrors.

We have seen the reasons already. Combat can't really be simulated because we don't know enough about war. The concepts we do have are drawn from the past, while many of the weapons are so new they have never functioned in war. Novel weapons of unprecedented lethality exist, so lethal, in fact, that we don't even know how to quantify them in wargames. As if these gaps in our knowledge were not enough, umpires and game controllers add an extra dash of subjectivity. Simulations thrive in the realm of subjective input data, where assumptions and model logic rule outcomes.

A 1980 report by the General Accounting Office (GAO) concluded that the problems of wargames were beyond science. The wide range and importance of simulation variables, the GAO found, restricts wargames to "squishy" simulation models, not rigorously quantifiable progressions in an engineering or accounting sense. Wargame models may be given a mathematical form, but they are essentially superficial. The GAO determined that the supposed validity of the combat models "evaporates rapidly when probed to any great extent." The report emphasized a need for simulations such that "the part of the model that is science matches the real world." Equally important is the need for "transparent" models that can be explained to and understood by the users.

The Army, at least, is well aware of these challenges. In 1971 it convened an ad hoc review committee, which eventually led in 1980 to a five-year program aimed at an entire new family of wargames. However, as of the time of this writing, the promised new age has yet to see a dawn.

Even designers of military simulations, not least officials of SAGA, warn against taking wargames too seriously. As we have seen, experienced officers are quick to complain of artificialities, and crisis game participants assert that too much action is dictated by the scenario or mandated by the game directors.

The wargame mystique has arisen despite this awareness of the problems with simulation. Perhaps the reason is the impressive level of detail incorporated into the games, perhaps it is the trappings of scientific method that surround them. Even manual, map-based wargames are replete with tables and charts, pages of numbers and statistics whose validity may be visible only to experts. It is not difficult for a player to be misled into believing that his synthetic experience is somehow "real."

The inherent complexity of modern warfare compounds other difficulties of wargames. As the cost of weapons increases and their roles overlap, decisions on resource allocation become tougher, especially when the pace of technological change creates machines different from those of the past. Then analytical techniques, including wargames, become the only guides to making these decisions. As a consequence, misplaced reliance on simulation techniques becomes positively dangerous—a question of dollars and sense in peacetime but of blood and consequences in war. The wargames mystique is a real problem, not just a theoretical one.

A well-designed wargame gives insights into the reasons some actions might be more effective than others. This is why military maneuvers are among the most useful wargames. Even synthetic experience can serve to illustrate the kinds of things to expect from a situation. But simulations have only a tenuous grip on reality. Appropriate tactics and behavior are built right into the design. Each fault or gap in the model translates into another path along which the game parts way with reality, aggressive players can exploit loopholes in the rules for their own purposes, and merely identifying all the elements that should be modeled is nearly impossible because we don't fully understand war. Given these weaknesses, any claim that simulations can attain actual predictability is rooted in the wargames mystique—the wish that it were so.

There is a special problem too in the effort to design hypothetical simulations of the present and future. As discussed earlier, the interactions of the weapons of future warfare can be guessed at but never known. All existing experience lies in the past. Just as generals tend to fight the "last war," so game designers reach into the past for their models of the future. Since there is no reference point for the concept of future warfare, the thought process in designing the future game cannot be deductive. Hypothetical wargames are almost always based on inductive and sometimes circular reasoning.

At one time the computer was seen as the panacea for the problems of game design. With its speed in manipulating numbers, some people thought the computer would allow so many facets of a situation to be modeled that true "realism" would result. Instead, as layer upon layer of detailed subroutines have been piled on top of the original designs, the

playing time requirements, and especially the setup time needed, have risen even faster than the speed of the computers' Meanwhile, the game models themselves remain open to the charge that other important elements are being ignored More serious still is the danger of newly added levels of detail unbalancing the original wargame. Computer games are that much harder to compare, contrast, or correct, and their designers end up making the same kinds of trade-offs between "realism" and playability ' that we see in commercial gaming While adding to the wargame mystique, computers have also added new problems

Many simulation users have faced the problems of "realism' and come away with the conclusion that their models can have but limited utility As Robert J Murray, formerly of the Naval War College, puts it, "If there's anyone who scares me, it is someone who goes to one wargame and thinks he s learned the answers to his problem, whatever the problem may be '

Over a century ago the German military thinker Karl von Clausewitz wrote that 'everything in war is simple, but the simplest thing is difficult. "Clausewitz s aphorism is also true if we substitute *wargaming* for *war*. It is easy to decide that phenomena like war can be mimicked in a game It is much more difficult to identify, collect, and verify all the relevant data, and it is more difficult still to design a game that captures all facets of the reality For war is an enigma. Troops, tanks, and aircraft can be counted ad infinitum without increasing actual knowledge History is strewn with examples of nations defeated in wars despite superior forces and firepower, not least the recent case of the United States in Vietnam. But wargames are quantitative; mathematically, simulation techniques inherently favor the larger numbers, and predictions made from these games must be viewed with some suspicion The clear conclusions we expect to draw from a simulation rest on the ambiguities of warfare

Finally, wars are fought by people, at each stage the choices of actors influence the end result This makes teams and players vital elements in the process of simulation, while the trend toward automated wargames ultimately threatens to eliminate players entirely Excessive automation is a mistake from the standpoint of simulation, which is simultaneously robbed of the ingenuity of human thought and the unpredictability of human action.

In the end, a wargame is a fiction from the instant play begins The fiction may be thoroughly believable and may be based on rational judgments about weapons and warfare, but it remains fiction. The reality of a wargame is an illusion, and the designer achieves success precisely by making that illusion believable Players derive value from the fiction because it frees them to explore the range of potential strategies within a single simulation framework But there is a difference between credible fiction and simulation of reality, and to lose sight of this fiction is to succumb to the wargame mystique

FOR FURTHER READING

There is a vast literature on war, battles, and military capabilities. Much of this is relevant to wargaming, but the literature specifically on simulation is scarce by comparison. A reading program on simulation would include both of these resources, but I will deal mainly with items from the simulation field.

The mimeographed *Fundamentals of War Gaming* by Francis J. McHugh (Newport, R.I., Naval War College Press, 1966) has stood for over 40 years as an instructive text. Now in its fourth edition, this book marked an advance in American simulation use before World War II. A popular treatment of wargaming is the emphasis of *The Bomb and the Computer* (New York: Delacorte Press, 1968) by British journalist Andrew Wilson. An excellent recent study of the simulation design questions, but from a more technical viewpoint, is *The Military Applications of Modeling* (Washington, Government Printing Office, 1984), edited by John A. Battilega and Judith K. Grange. That modeling study emerged from a government research contract, as did the other major academic study on the subject, *The War Game* (Cambridge, Mass.: Harvard University Press, 1979) by Garry D. Brewer and Martin Shubik. Both of these authors have been frequent commentators on simulation issues and game theory.

The prewar games by the Japanese navy have received attention ever since 1946, when an account by a Japanese prisoner of war was included in the joint congressional hearings that investigated the Japanese attack (*Hearings before the Joint Committee on the Pearl Harbor Attack*, Washington: Government Printing Office, 1946). The Japanese wargame story is best told by the late Gordon W. Prange, who had interviewed many of the surviving participants at length (*At Dawn We Slept*, New York: McGraw-Hill, 1982). On the equally important Japanese wargames that prefigured the Battle of Midway, my selection for standard source despite many subsequent accounts, remains Mitsuo Fuchida and Masatake Okumiya's book *Midway: The Battle That Doomed Japan* (Annapolis, Naval Institute Press, 1955). Prewar games at the U.S. Naval War College have been examined in great detail by Michael P. Vlahos in *The Blue Sword* (Newport, R.I., Naval War College Press, 1980). Maneuvers at sea are also recounted in the memoir by Admiral J. O. Richardson (as told to George C. Dyer), *On the Treadmill to Pearl Harbor* (U.S. Navy, Naval History Division, 1973).

Several general surveys are available outlining the origins and history of simulations. One such source is *Wargame Design* (New York: Simulations Publications, 1977). There are also the books *Venture Simulation in War, Business and Politics* (New York: McGraw-Hill, 1971) by Alfred K. Hausrath, *Simulations and Society* (Boston: Allen & Unwin, 1969) by J. R. Raser, and R. D. Luce and H. Raiffa's *Games and Decisions* (New York: Wiley, 1957).

Details of the hypothetical "Aggressor" nation and military forces are supplied by Field Manual 30-103, *Aggressor Order of Battle* (U.S. Army, June 1959). Atomic field exercises are the subject of *Atomic Soldiers* (Boston, Beacon Press, 1980). There is a bird's-eye view of the Fort Irwin National Training Center in "Beep, Beep, You're Dead" (*Harper's*, October 1983), by Schuyler Ingle. The Air Force's equivalent live maneuver center features in *Red Flag: Air Combat for the 80s* (Novato, Calif., Presidio Press, 1984). On the general usefulness of military exercises, see Frederick Thompson, "Did We Learn Anything from That Exercise? Could We?" (*Naval War College Review*, July-August 1982).

A survey of think tanks can be found in *The Shadow Government* (New York, Pantheon, 1976) by Daniel Guttman and Barry Willner. Bruce L. R. Smith covers one such organization in detail in *The Rand Corporation* (Cambridge, Mass., Harvard University Press, 1966). A provocative view of the performance of private strategists has been advanced by Colin S. Gray, initially in the paper "What Rand Hath Wrought" (*Foreign Policy*, 4, Fall 1971). This salvo was in turn answered in the next issue of the same journal in Bernard Brodie's illuminating paper "Why Were We So (Strategically) Wrong?"

Discussions of Rand wargames and other simulations in this book are based on that think tank's own descriptive materials. Rand has published many papers on simulations and on game theory that are still available; see Rand's lists of abstracts for details of titles in print. The account of a Rand wargame used for the 1955 net estimate was developed from my own research and is presented here for the first time.

A sampling of typical "firepower scores" assigned to ground combat units can be found in *Weapons Effectiveness Indices and Weighted Unit Values* (Publication CAA-SR-73-18, U.S. Army Concepts Analysis Agency, April 1974). A similar sort of quantification is that suggested by Trevor N. Dupuy in his book *Numbers, Prediction, and War* (Indianapolis, Bobbs-Merrill, 1979). A vital critique of scoring methods along the lines followed here is the Rand paper by Dr. Jacob A. Stockfisch, *Models, Data, and War* (R-1526-PR, March 1975).

One treatment from the standpoint of defense analysis that comments on a number of military simulations is in Reiner K. Huber et al., eds., *Military Strategy and Tactics* (New York, Plenum, 1975). An essential study from an official source is the General Accounting Office report *Models, Data, and War: A Critique of the Foundation for Defense Analysis* (PAD-80-21, March 12, 1980).

Procedures for wargaming are explained in great detail in the *Joint Wargaming Manual* (JWGA-167-69, Organization of the Joint Chiefs of Staff: Joint War Games Agency, July 1, 1969). On the Studies Analysis and Gaming Agency, see the article by former official Dr. Francis B. Kapper, "Wargaming and Crisis Management" (*Defense*, May 1981), which also serves as a general introduction to modern practice.

Useful sources for academic work in this field are the journal *Simulations and Games* and the *Journal of Conflict Resolution*. A related publication that also deals with systems analysis is *Phalanx*, the newsletter of the Military Operations Research Society.

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